

IMPACTS OF INSTABILITY TRAINING ON THE PHYSICAL FITNESS OF SOCCER STUDENTS



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IMPACTOS DO TREINO INSTÁVEL SOBRE A APTIDÃO FÍSICA DE ESTUDANTES DE FUTEBOL

IMPACTO DEL ENTRENAMIENTO INESTABLE EN LA APTITUD FÍSICA DE ESTUDIANTES DE FÚTBOL

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ABSTRACT

Introduction: Most coordination studies are conducted in stable environments, unable to realistically simulate an environment integral to the sports field. The concept of instability training applies the principles of sports physiology, combining real situations from the soccer game to improve students' sporting ability, and has gained attention from coaches, although it still lacks scientific evidence. **Objective:** Study the concept of instability training by evaluating its optimization and development effects on soccer students' motor coordination. **Methods:** Fifty college soccer students were selected. The students were randomly divided into experimental and control groups, without relevant statistical differences. The experiment lasted one hour daily, three times a week, for six weeks. The control group remained with the usual training while the experimental group had the instability training protocol added. Balance test results were collected with frontal and posterior lower limb support and comprehensive posterolateral scores. Changes in activity performance were also analyzed with the results collected before and after the intervention. **Results:** The score of the experimental group without support was increased from 101.14 ± 8.22 to 108.73 ± 8.54 , higher than the control group (103.8 ± 58.11). The comprehensive score of the experimental group was from 88.85 ± 6.10 to $99.85+8.87$, also higher than the control group (88.15 ± 6.43). **Conclusion:** The effects of instability training to optimize and develop motor coordination in soccer students proved to be superior to usual training, and its introduction into daily training is indicated for more effective promotion of students' fitness level. **Level of evidence II; Therapeutic studies: investigation of treatment outcomes.**

Keywords: Soccer; Physical Fitness; Physical Education and Training; Students.

RESUMO

Introdução: Grande parte dos estudos de coordenação são feitos em ambientes estáveis, incapazes de simular realisticamente um ambiente integral para o campo esportivo. O conceito de treinamento instável aplica os princípios da fisiologia esportiva, combinando situações reais do jogo de futebol para aprimorar a capacidade esportiva dos estudantes e tem ganhado atenção dos treinadores, embora ainda careça de evidências científicas. **Objetivo:** Estudar o conceito de treinamento instável avaliando seus efeitos de otimização e desenvolvimento sobre a coordenação motora dos estudantes de futebol. **Métodos:** Foram selecionados 50 estudantes universitários praticantes de futebol. Os estudantes foram divididos aleatoriamente em grupo experimental e controle, sem diferenças estatísticas relevantes. O experimento teve duração de uma hora diária, três vezes por semana, durante seis semanas. O grupo controle permaneceu com os treinos habituais enquanto ao grupo experimental foi adicionado o protocolo de treinamento instável. Foram coletados resultados de teste de equilíbrio com apoio frontal e posterior de membros inferiores, além de pontuação abrangente pósterolateral. Alterações no desempenho de atividades também foram analisados com os resultados coletados antes e após a intervenção. **Resultados:** A pontuação do grupo experimental sem apoio foi ampliada de $101,14 \pm 8,22$ para $108,73 \pm 8,54$, superior ao grupo controle ($103,8 \pm 58,11$). A pontuação abrangente do grupo experimental foi de $88,85 \pm 6,10$ para $99,85+8,87$, também superior ao grupo controle ($88,15 \pm 6,43$). **Conclusão:** Os efeitos do treinamento instável para otimização e desenvolvimento de coordenação motora dos estudantes de futebol mostrou-se superior ao treino habitual, sendo indicada a sua introdução ao treinamento diário para uma promoção mais eficaz do nível de aptidão física dos estudantes. **Nível de evidencia II; Estudos terapêuticos: investigação dos resultados de tratamento.**

Descritores: Futebol; Aptidão Física; Educação Física e Treinamento; Estudantes.

RESUMEN

Introducción: Gran parte de los estudios de coordinación se realizan en entornos estables, incapaces de simular de forma realista un entorno propio del campo deportivo. El concepto de entrenamiento inestable aplica los principios de la fisiología deportiva, combinando situaciones reales del juego de fútbol para mejorar la capacidad deportiva de los estudiantes y ha ganado la atención de los entrenadores, aunque todavía carece de evidencia científica. **Objetivo:** Estudiar el concepto de entrenamiento inestable evaluando sus efectos de optimización y desarrollo en la coordinación motora de los estudiantes de fútbol. **Métodos:** Se seleccionaron 50 estudiantes universitarios de fútbol. Los estudiantes fueron divididos aleatoriamente en grupo experimental y en grupo control, sin diferencias estadísticas relevantes. El experimento duró una hora diaria, tres veces por semana, durante seis semanas. El grupo de control permaneció con



los entrenamientos habituales, mientras que al grupo experimental se le añadió el protocolo de entrenamiento inestable. Se recogieron los resultados de las pruebas de equilibrio con apoyo frontal y posterior de los miembros inferiores, además de la puntuación posterolateral global. También se analizaron los cambios en el rendimiento de la actividad con los resultados recogidos antes y después de la intervención. Resultados: La puntuación del grupo experimental sin apoyo pasó de $101,14 \pm 8,22$ a $108,73 \pm 8,54$, superior a la del grupo control ($103,8 \pm 58,11$). La puntuación integral del grupo experimental pasó de $88,85 \pm 6,10$ a $99,85 \pm 8,87$, también superior a la del grupo control ($88,15 \pm 6,43$). Conclusión: Los efectos del entrenamiento inestable para optimización y desarrollo de la coordinación motora de los estudiantes de fútbol demostraron ser superiores al entrenamiento habitual, siendo indicada su introducción en el entrenamiento diario para una promoción más eficaz del nivel de aptitud física de los estudiantes. **Nivel de evidencia II; Estudios terapéuticos: investigación de los resultados del tratamiento.**

Descriptor: Fútbol; Aptitud Física; Educación y Entrenamiento Físico; Estudiantes.

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INTRODUCTION

Sports coordination is an essential ability to become a professional athlete, and it is also the focus of the current research on daily training of sports students.¹ In football, athletes need to run around the field, and complete the actions of passing the ball and shooting in the running. The athletes always maintain the state of movement in the whole process. This is a kind of unstable scene, which puts forward higher requirements for the individual coordination ability of athletes.² According to the existing literature, all organs, tissues, joints and movement hubs of the body can cooperate with each other to complete an action under the guidance of a unified goal during the movement period. This ability is called coordination.³ There are also documents that explain the formation of coordination, and think that the factors that affect the coordination of athletes, in addition to the congenital genetic factors, there are also the influence of external environment and the added value of the acquired training.⁴ As the reserve of professional football players, football special students receive professional and systematic teaching in football, so they need to strengthen the training of action coordination. However, most of the existing coordination studies are in a relatively stable environment, which can not simulate a more suitable environment for the sports field.⁵ Therefore, this paper introduces the concept of unstable training, applies the principles of sports physiology, combines the actual situation of football and the sports ability of football students, and adds the concept of unstable training, so that the growth of football players' unstable training and coordination ability can complement each other, and studies the optimization effect of the development law on the coordination of football students' movements, and provides some personal suggestions.⁶

METHOD

Selection of research objects

In this paper, 50 sophomore football students in a university were selected. Their age, height, weight and training years are shown in Table 1, $P > 0.05$, indicating that there is no significant difference. The study and all the participants were reviewed and approved by Ethics Committee of North China University of Water Resources and Electric Power (NO.NCUWRE20-F055). The grades of these students are at the middle level of the class. There is little difference between them and there is also good room for improvement.

Table 1. Basic properties of two groups of research objects.

Group	Experience group	Control group
Age (years)	19.25 ± 2.31	20.74 ± 2.78
Height (cm)	175.49 ± 2.86	176.35 ± 4.91
Body weight (kg)	72.38 ± 6.53	71.81 ± 7.28
Training years (years)	3.31 ± 2.79	4.18 ± 1.85

The following points should be followed during the experiment: First, 50 football special sports students should fully comply with the training plan of the researchers to ensure that they are fully engaged in training and that the quality and quantity of training are guaranteed, and there is no negative perfunctory situation, so as to ensure the effectiveness of the implementation of the training plan. Secondly, when grouping football special students, they were not told which was the control group and which was the experimental group, so that each student could conscientiously complete the action test and reduce the interference of knowing that they were the control group on the experimental results. Third, the daily work and rest time and diet arrangement of the experimental group and the control group are almost the same, and the other exercise conditions of the students in the two groups are completely the same, so as to reduce the interference of unrelated variables on the experimental results. Fourth, if these 50 football students are absent from training due to some irresistible factors, the data need to be excluded.

Design of experimental scheme

There are 25 experimental groups and 25 control groups in this experiment, using the form of control experiment. Within six weeks after the start of the experiment, the experimental group adopted the form of suspension training and unstable training to create an unstable training environment, and carried out the relevant content of coordinated training. The control group continued to use the existing coordination training mode. The experiment is carried out three times a week, each time for one hour. Before and after the experiment training, the warm-up training and the stretching exercise after the end of the experiment should be fully done to prevent the impact of sports injury on the students' body, so as not to interfere with the experiment results. Before and after the experiment, the data were measured and analyzed using data processing software, such as Excel.

Index selection and test method

When testing the football special college students, starting from the three aspects of dynamic balance ability, action coordination and football performance, we first selected the y-type balance test as the test method of dynamic balance ability, measured the strengths and weaknesses of the football special college students, and calculated the scores of the unsupported leg in front (A), the unsupported leg in the back inside (PM) Non-supporting leg score (PL) and comprehensive score (YBT-CS) in the posterolateral side.

Secondly, it selects the indicators such as the time of changing running, the time of jumping forward and backward, the time of folding line dribbling around the pole and so on to analyze the coordination of the action of the football special college students. Finally, it selects

the scoring criteria of the mid-term examination of the football special college students to test, and takes the test results as the evaluation criteria of this experiment, so as to have a more intuitive understanding of the students' competitive level.

RESULTS

Influence of unstable training on dynamic balance ability of football majors

It can be seen from Table 2 that before the experiment, there was no significant difference in the dynamic balance score of the dominant side between the two groups of football majors ($P>0.05$), indicating that there was no significant difference. In the dynamic balance score of the dominant side, the score (A) of the unsupported leg in the front of the experimental group was optimized from (63.15 ± 3.97) before the experiment to (79.14 ± 3.26) after the experiment, which was higher than (63.04 ± 4.56) in the control group;

The post-medial score (PM) of the non-supporting leg was optimized from (101.14 ± 8.22) before the experiment to (108.73 ± 8.54) after the experiment, which was higher than (103.8 ± 58.11) in the control group; The posterolateral score (PL) of the non-supporting leg was optimized from (98.31 ± 7.89) before the experiment to (105.47 ± 6.43) after the experiment, which was higher than (100.68 ± 7.69) in the control group; The comprehensive score (YBT-CS) was optimized from (88.85 ± 6.10) before the experiment to (99.85 ± 8.87) after the experiment, which was higher than (88.15 ± 6.43) in the control group.

It can be seen from Table 3 that before the experiment, there was no significant difference in the dynamic balance score of the inferior side between the two groups of football majors ($P>0.05$), indicating that there was no significant difference. In the dynamic balance score of the inferior side, the score (A) of the non-supporting leg in the front of the experimental group was optimized from (63.79 ± 4.73) before the experiment to (80.74 ± 3.28) after the experiment, which was higher than that of the control group (62.34 ± 4.13) ;

The post-medial score (PM) of the non-supporting leg was optimized from (100.57 ± 9.52) before the experiment to (109.32 ± 8.75) after the experiment, which was higher than (102.67 ± 9.18) in the control group; The posterolateral score (PL) of the non-supporting leg was optimized

Table 2. The Influence of Sports Training on the Dynamic Balance of the Dominant Side of Football College Students.

Group	Score	Before experiment	After experiment
Experience group	A	63.15±3.97	79.14±3.26
	PM	101.14±8.22	108.73±8.54
	PL	98.31±7.89	105.47±6.43
	YBT-CS	88.85±6.10	99.85±8.87
Control group	A	64.36±3.58	63.04±4.56
	PM	102.26±7.26	103.8±58.11
	PL	99.12±7.72	100.68±7.69
	YBT-CS	88.27±5.80	88.15±6.43

Table 3. The Influence of Sports Training on the Dynamic Balance of the Inferior Side of Football College Students.

Group	Score	Before experiment	After experiment
Experience group	A	63.79±4.73	80.74±3.28
	PM	100.57±9.52	109.32±8.75
	PL	97.13±8.27	106.87±7.23
	YBT-CS	87.36±7.72	97.65±8.69
Control group	A	62.68±3.98	62.34±4.13
	PM	101.93±7.19	102.67±9.18
	PL	98.24±9.45	100.43±10.27
	YBT-CS	89.01±7.63	90.12±7.06

from (97.13 ± 8.27) before the experiment to (106.87 ± 7.23) after the experiment, which was higher than (100.43 ± 10.27) in the control group; The comprehensive score (YBT-CS) was optimized from (87.36 ± 7.72) before the experiment to (97.65 ± 8.69) after the experiment, which was higher than (90.12 ± 7.06) in the control group. A comprehensive comparison of the research results of the dynamic balance changes of the advantage test and the disadvantage test of the football special college students shows that the unstable training can enhance the dynamic balance scores of both sides of the football special college students, and the dynamic balance scores of the disadvantage side are better improved. After training, the balance of both sides of the college students tends to be consistent, which reduces the instability of both sides of the athlete's body during the exercise process, and the coordination performance of the body changes more obviously.

The influence of unstable training on the coordination of football students

It can be seen from Table 4 that before the experiment, there was no significant difference between the two groups of football special college students in such indicators as the time for changing running, the time for jumping forward and backward, and the time for zigzag dribbling around the pole, $P>0.05$, indicating that there was no significant difference. In the index of motor coordination, the change of running time in the experimental group was optimized from (12.85 ± 0.44) seconds before the experiment to (11.55 ± 0.37) seconds after the experiment, which was superior to (12.79 ± 0.46) seconds in the control group; The time for jumping forward and backward was optimized from (14.28 ± 0.92) seconds before the experiment to (13.02 ± 0.72) seconds after the experiment, which was better than (13.61 ± 0.47) seconds in the control group; The time of the broken line dribble around the rod was optimized from (11.35 ± 0.32) seconds before the experiment to (10.38 ± 0.43) seconds after the experiment, which was better than (11.31 ± 0.52) seconds in the control group. It can be seen from this that the existing coordination training mode of the control group can also optimize the work coordination of football special college students to a certain extent, but the effect is not obvious.

Influence of unstable training on football performance of football majors

Football is a comprehensive sport that combines a variety of sports qualities. Therefore, the coordination ability not only affects the score of some decomposed actions, but also affects the overall football performance of athletes. In this section, applying the scoring criteria in the mid-term examination, the football scores of two groups of special students are scored before and after the experiment. The specific results are shown in Table 5.

It can be seen from Table 5 that before the experiment, there was no significant difference between the two groups of football majors'

Table 4. The Influence of Sports Training on the Action Coordination of Football College Students.

Group	Option	Before experiment	After experiment
Experience group	Change Run (seconds)	12.85±0.44	11.55±0.37
	Forward and backward jump hurdles (seconds)	14.28±0.92	13.02±0.72
	Broken line dribble around the pole (seconds)	11.35±0.32	10.38±0.43
Control group	Change Run (seconds)	12.90±0.47	12.79±0.46
	Forward and backward jump hurdles (seconds)	14.35±0.57	13.61±0.47
	Broken line dribble around the pole (seconds)	11.42±0.41	11.31±0.52

Table 5. The Influence of Sports Training on the Football Performance of College Students.

Group	Before experiment	After experiment
Experience group	75.01±3.07	79.57±2.55
Control group	75.57±2.23	75.60±3.57

football scores ($P>0.05$), indicating that there was no significant difference. Among the football performance indicators, the score of the experimental group increased from (75.01 ± 3.07) before the experiment to (79.57 ± 2.55) after the experiment, which was higher than that of the control group (75.60 ± 3.57) . The research results show that sticking to the existing coordination training can also subtly improve the performance of football students, but the effect is not significant. In the fierce competition, slow progress is equal to backward, so the coordinated training method adopted by the control group in this paper is limited.

DISCUSSION

Football is not simply running and chasing, but to be able to quickly judge tactics and complete body movements in the face of many people blocking and fighting during the movement. Therefore, this kind of movement has very high requirements on the players' ability to react on the spot, mental level, action skills, coordination and stability. Enhancing the coordination of athletes can make their movements more skillful, enhance their self-confidence, and promote them to give full play to

their personal abilities in the fierce competition to win the competition. In short, coordination refers to the ability of athletes to control their own muscles and bones, and whether athletes can reasonably adjust their own movement organs under the control of nerves and muscles, operate them to complete all kinds of running stops, turns, turns and dribbles, and can always maintain their own stability without falling and other accidents. It can be said that good coordination ability can also reduce athletes' sports injuries on the sports field and prolong their sports life.

CONCLUSION

The characteristics of football show that athletes need good coordination performance on the football field to make themselves invincible, gain more initiative, reduce sports injuries and extend their professional life. In this paper, unstable training is added to the content of coordination training, trying to create an unstable environment similar to that on the football field, so that athletes can better adapt to the environment and get better play in the actual game. The results show that the effect is better after the experiment when the unstable training is added to the coordination training. Therefore, in coordination training, it is necessary to increase the content of unstable training and create a more suitable environment for football, so as to promote the level of coordination of football.

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REFERENCES

1. Eccles DW, Tran KB. Getting them on the same page: Strategies for enhancing coordination and communication in sports teams. *J Sport Psychol Action*. 2012;3(1):30-40.
2. Vandendriessche JB, Vandorpe BFR, Vaeyens R, Malina RM, Lefevre J, Lenoir M, et al. Variation in sport participation, fitness and motor coordination with socioeconomic status among Flemish children. *Pediatr Exerc Sci*. 2012;24(1):113-28.
3. Witte K, Ganter N, Baumgart C, Peham C. Applying a principal component analysis to movement coordination in sport. *Math Comput Model Dyn Syst*. 2010;16(5):477-88.
4. Vesper C, Schmitz L, Safra L, Sebanz N, Knoblich G. The role of shared visual information for joint action coordination. *Cognition*. 2016;153:118-23.
5. Cejudo GM, Michel CL. Addressing fragmented government action: Coordination, coherence, and integration. *Policy Sci*. 2017;50(4):745-67.
6. Ridderinkhof KR. Neurocognitive mechanisms of perception-action coordination: A review and theoretical integration. *Neurosci Biobehav Rev*. 2014;46(Pt 1):3-29.