International Journal for Housing Science and Its Applications
Publish August 10, 2025. Volume 46, Issue 4 Pages 7186-7194

https://doi.org/10.70517/ijhsa464623

An analysis of the impact of functionalized residential design for sports rehabilitation on the post-injury recovery effects of professional athletes

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Abstract As theories of sports rehabilitation continue to evolve, functional residential design has been proposed as a new way to help athletes recover from injury. Athletes require not only appropriate medical interventions but also support in their living environment during their recovery from injury. By integrating wellness, healing, and adaptive spaces, functionalized residential design for sports rehabilitation can provide multi-dimensional assistance both physically and psychologically, thus facilitating the overall recovery of athletes. This paper analyzes the impact of functionalized housing design for sports rehabilitation on the post-injury recovery effects of professional athletes. The research subjects were 30 professional athletes in a province, which were divided into experimental and control groups by using experimental method and questionnaire survey method. The experimental group performed sports rehabilitation training in a functionalized residential environment, while the control group trained in a traditional training room. The recovery effects of the two groups were analyzed by measuring the indexes of blood lactate, creatine kinase, sports performance and psychological condition. The results showed that the experimental group recovered blood lactate more rapidly than the control group, with p-values of 0.013 and 0.008, respectively, and the experimental group recovered creatine kinase significantly better than the control group, with p-values of 0.004 and 0.001, respectively, and the experimental group showed a more significant improvement in athletic performance and psychological condition, with an increase in explosive power of 1.01, compared with 0.49 in the control group, with p-values of 0.002. The conclusion shows that the design of functionalized housing for sports rehabilitation can effectively promote the post-injury recovery of professional athletes, enhance sports performance and improve psychological status.

Index Terms sport rehabilitation, functionalized housing design, professional athletes, post-injury recovery, creatine kinase, psychological condition

I. Introduction

As professional sports become increasingly competitive, physical health and rehabilitation become especially important. Injuries are inevitable for professional athletes, but it becomes a challenge to effectively rehabilitate to return to peak performance [1], [2]. A very important goal in the study of recovery from post-traumatic sports injuries is to maximize the recovery of athletes' motor skills so that they can return to the sports field and the playing field as soon as possible and produce excellent results, while the correct treatment and rehabilitation methods play an important role [3]-[5]. If not treated properly, an athlete's athletic career is often shortened significantly.

At present, the treatment of injuries in different parts of the athlete can be divided into several categories such as non-surgical treatment, surgical treatment, rehabilitation physiotherapy and traditional Chinese medicine treatment, etc. These rehabilitation modes are based on regular hospital or training base rehabilitation training, but due to the tightness of beds, insufficient rehabilitation equipment, and the lack of rehabilitation instructor doctors, the average daily length of athletes' rehabilitation is less than 2 hours, which increases the time spent on at-home rehabilitation [6]-[9]. Therefore, there is an increasing demand for home rehabilitation training, but home rehabilitation training lacks professional equipment and activity space and environmental support, and athletes with leg and foot injuries have an increased risk of falling during the recovery period at home, limiting the effect of athletes' post-injury recovery [10]-[12]. Moreover, for different rehabilitation training, there are differences in the physiological recovery needs of athletes, such as muscle injuries and ligament strains in the height of the staircase and space span needs are different, knee and ankle joints and other articular and Achilles tendon injuries recovery of the friction coefficient of the ground requirements are extremely high [13], [14]. In addition, in the stage of injury recovery, the mental

health of athletes is worthy of attention, as the spatial limitations brought about by injuries lead to negative emotions such as anxiety and a sense of social detachment [15], [16].

With the improvement of people's living standards, the demand for housing is no longer limited to the residential function, but rather, they hope that the housing can have more diversified and specialized functions to meet the needs of life, work, entertainment and other aspects [17]. In this dual context, it is necessary to embed the design of sports rehabilitation function in the residence for the post-injury recovery of professional athletes.

With the continuous progress of sports science and technology, the training and rehabilitation of athletes have been constantly innovated and improved. The traditional methods of sports rehabilitation, although relieving the post-injury symptoms of athletes to a certain extent, are still insufficient in terms of actual results. Sports rehabilitation should not only focus on physiological recovery, but also take into account the impact of psychological state and environmental factors on athletes. In this context, functionalized housing design, as an innovative means of rehabilitation, has gradually entered the vision of athletes' post-injury recovery. Functionalized residential design emphasizes the comprehensive impact of the environment on athletes' recovery, not only providing physiological space suitable for sports recovery, but also focusing on psychological and emotional regulation, providing a comprehensive recovery environment for athletes.

The main objective of this study is to explore the actual effect of functionalized residential design intervention on professional athletes' post-injury recovery. To this end, the study designed a controlled experiment in which 30 professional athletes from a province were selected and divided into an experimental group and a control group to implement an 8-week experimental intervention. The athletes in the experimental group will undergo sports rehabilitation in a functionalized residential environment, while the control group will continue to train in a traditional rehabilitation environment. The effectiveness of the functionalized residential design in sports rehabilitation will be assessed by comparing the two groups of athletes in terms of multidimensional recovery indicators such as blood lactate, creatine kinase, athletic performance, and psychological condition.

The focus of the study was to verify whether functionalized residential design could significantly improve the physiological and psychological status of athletes and enhance their sports performance. The potential role of functionalized residential design was further revealed by comparing and analyzing the recovery of the two groups, especially the differences in biochemical indicators (e.g., blood lactate, creatine kinase) and sports performance. This study not only has theoretical significance, but also provides a valuable reference for exercise rehabilitation practice.

II. Functionalized Residential Design for Exercise Rehabilitation

II. A. Design principles

II. A. 1) Principles of healing in assisted movement rehabilitation

The World Health Organization (WHO) has updated its definition of health, which no longer means only the absence of disease and disability, but only a good state of health in all three dimensions: psychological, physical and social. In the view of rehabilitation medicine, the rehabilitation of the sick, injured and disabled also includes these dimensions, i.e. physiological rehabilitation, psychological rehabilitation, vocational and social rehabilitation, and ultimately their reintegration into the society. Exercising people will actively choose the functional space with health services, and passively accept the influence of the environment on themselves in the process of physical-medical integration activities. Therefore, when designing the building, not only should it provide sufficient health services, but also consider the environmental atmosphere, social distance and other environmental factors that will affect the mental health of the athletes, so as to provide an environment that can help the athletes to restore their health from the physiological, psychological, social, learning, working and other dimensions.

II. A. 2) Adaptive principles to guarantee body-health synergies

The design of community sports and health center under the background of physical and medical integration is not simply adding a medical function directly to the scope of the original sports space or the space boundary, but under the guidance of the relevant theoretical background, the two kinds of space have been adapted to change for the same goal of cooperation, and organically blended into a whole. Sports activities are usually larger in scope and belong to the dynamic area, while medical activities are often smaller in scope and belong to the static area, and some spaces also have both specific and medical characteristics. Different groups of people go back and forth between different functional spaces, influencing each other. How to facilitate the activities of a variety of people, how to adapt to the service process of multiple situations at the same time, and how to make each process go smoothly, the architectural space that needs to be designed has strong pertinence and adaptability, for different groups of people, adapts to different functions, and takes into account different processes, so that "body" and "medicine" complement each other and assist each other, and truly work together to contribute to the health of athletes, and realize the effect of "1 1 > 2" in sports and medicine synergy.

II. A. 3) Promoting the principle of universality in public health

The ultimate goal of physical and medical integration is to promote the health of the nation; therefore, physical and medical integration services need to reach the majority of the population and be accessible and enjoyable for athletes. Controlling the cost of use, integrating diversified services, and increasing the number of venues are important aspects to ensure the popularization of body-medicine integration services to remote mobilizers. The cost of use includes both time cost and economic cost. Controlling the time cost mainly lies in shortening the distance of athletes from sports and health centers, the closer the time cost is, the higher the motivation of the public to participate. From the perspective of architectural design, controlling the economic cost is mainly to emphasize green energy saving, sustainable development, etc., while expanding the profitability of community sports and health centers. This requires the sports and health center to take health as the base, on the one hand, the business form will be dispersed to the elderly, health, traditional Chinese medicine, education and other related fields, to provide athletes with one-stop health services; on the other hand, combined with the end of the modern means of information, in the actual volume of space into zero, in the network platform will be the sports and medical resources into a whole, the formation of network-type layout of services. Using the design strategy of function and environment, the sports health center penetrates into more existing service places to improve its coverage, and at the same time brings more active people with health goals to the sports health center, aiming to enhance the effect of athletes' post-injury recovery.

II. B.Design path

II. B. 1) Multi-scene introduction of natural light

Natural light is pleasant and the window images it brings are equally healing, these are the most readily available and free of charge, and at the same time the most accessible positive landscape elements. In order to introduce more natural light and provide more visible landscape healing factors for indoor exercisers, community sports and health centers should be arranged in a north-south orientation as much as possible to prolong the time of indoor access to natural light on the basis of meeting the requirements of the relevant planning and construction indexes.

(1) Introduction of sports space

The most direct role of natural light is lighting, should be prioritized to allow sports and exercise personnel to obtain the most adequate sunlight in the area of long-time high-frequency stay activities, such as sports prescription training space should be prioritized in the overall design of the program towards the south.

(2) The introduction of rest space

Natural light has the role of reflecting other natural landscapes, and at the same time, it is also a natural landscape itself, and the gentle sense of light can bring a healing visual experience.

(3) Introduction of physical therapy space

The source of energy of life on earth is sunlight, and natural light has a natural therapeutic effect on physiology, which can help sports and exercise personnel synthesize calcium in the body and kill bacteria and viruses. The introduction of natural light in the physical therapy room can not only heal the patients psychologically, but also have therapeutic effects on the human body physiologically.

II. B. 2) Landscaped use of natural water bodies

Water is the source of life, a major component of our bodies, and as a natural landscape it also has therapeutic properties. Bright bodies of water are an elixir for the mind and the eyes, giving them a sense of clarity and pleasure. Although compared with natural light, want to introduce water into the indoor environment usually need higher cost, but its therapeutic effect has been recognized, and there have been a lot of foreign countries to introduce the water landscape of the community sports and health center building good examples.

(1) Landscape water system

Water design is an important part of the healing environment of sports and health centers. Safe and positive water design can bring a positive and refreshing atmosphere to help patients with motor dysfunction reduce the discomfort caused by sports training. For example, the installation of ornamental pools or landscape water curtains in the reception area and specialist consultation rooms will have a good effect on balancing the emotions of sports exercisers and promoting health.

(2) Functional water system

According to the characteristics of the site and combined with the indoor space form, designed to flow into the form of zigzagging, and indoor greenery into one, bringing people a good visual experience at the same time, but also for hydrotherapy sports rehabilitation training.

II. B. 3) Indoor and outdoor arrangement of natural greenery

Cultivating and placing some common green plants in the indoor environment scientifically, such as chlorophyll, hanging orchids, etc., can not only beautify the environment, but also eliminate formaldehyde, benzene and other harmful chemicals, which can help human health. Flexible greening design can ease the conflict between the architectural image and the natural environment, reduce the mechanical indifference formed by the programmed construction of the lines and space, and synthetic materials to form a sharp contrast, so that people feel more vitality of life.

III. Research program design

III. A. Subjects of study

Taking 30 professional athletes in a province as research subjects, aiming to study the role of functionalized residential design of sports rehabilitation on the effect of post-injury recovery of professional athletes, an informed consent was issued for each subject before the experiment, and the experiment could be carried out only after obtaining the subject's consent.

III. A. 1) Source of subjects

A provincial men's professional sports team.

III. A. 2) Inclusion criteria

(1) 30 professional athletes in a province. (2) Aged 20-28 years old. (3) No major physical or mental illnesses, no joint injuries or movement disorders in the body in the last three months. (4) No smoking, alcoholism, etc.

III. A. 3) Removal criteria

(1) Those who had poor experimental compliance and were unmotivated. (2) Those who left in the middle of the experiment for other reasons and failed to complete the experiment. (3) Those who performed other training in addition to the main training and daily training. (4) Those who suffered major physical injuries during the experimental period, which affected the experimental effect.

III. B. Research methodology

III. B. 1) Literature method

According to the research purpose and research tasks of this thesis, data collection and literature review are carried out through the library of a sports academy and other platforms, as well as China Knowledge and Wanfang databases and other literature platforms. By using “sports rehabilitation”, “athletes' post-injury recovery effect” and “functionalized residential design” as the key words, we carried out evidence-based analysis of the literature through literature search to gain a deeper understanding of the intervention research and development of functionalized residential design on athletes' post-injury recovery effect. Through evidence-based analysis of the literature through literature search, we will gain an in-depth understanding of the current status of intervention research and development of functionalized residential design on athletes' post-injury recovery effects, summarize the relevant research on functionalized residential design at home and abroad, and provide a theoretical basis for the present study.

III. B. 2) Questionnaire method

The Athletes' Post-Injury Recovery Effectiveness Scale was adopted, which is most widely used in the related research fields at home and abroad to measure the athletes' post-injury recovery effectiveness status, and there are 15 questions in the scale, in which three dimensions of biochemical indexes (including items 1, 2, 3, 4, and 5), athletic performances (including items 6, 7, 8, 9, and 10), and psychological conditions (including items 11, 12, 13, 14, 15), when the test score is higher, it proves that the athlete's post-injury recovery effect is higher, at which time the timely implementation of countermeasures should be carried out. In the development of the Athletes' Post-Injury Recovery Effect Questionnaire, scholars tested its reliability, and through the questionnaire survey of more than 200 athletes in different sports, it was found that the average internal consistency coefficient of the three dimensions of the scale: biochemical indicators, athletic performance, and psychological condition was 0.843. After using the scale to assess the post-injury recovery effect of 5000 athletes in different sports, the average internal consistency coefficient of the three dimensions was 0.843, and the average internal consistency coefficient of the three dimensions was 0.843. The internal consistency coefficient of the scale is 0.819 for biochemical indexes, 0.833 for comfort level, and 0.822 for psychological condition, which can reflect the post-injury recovery effect of the athletes very well, and therefore the Athletes' Post-Injury Recovery Effectiveness Questionnaire was chosen as the test tool for this study. It was used as a way to screen the experimental subjects. A total of 30 copies of Athletes' Mental

Fatigue Scale were distributed in this study, and a total of 30 athletes were screened as the subsequent experimental subjects.

III. B. 3) Expert interview method

Through interviews with experts, teachers and coaches in related fields, we understand the reasons for the emergence of sports injuries and the means of recovery of sports injuries by various training teams, and at the same time, we review and organize the literature research on the effect of the functionalized residential design of sports rehabilitation on the recovery of athletes after injuries, and consult with experts and coaches about the feasibility of the functionalized residential design of sports rehabilitation on the effect of athletes recovering from injuries. At the same time, the experts and coaches were consulted on the feasibility of the functionalized housing design for sports rehabilitation on athletes' post-injury recovery.

III. B. 4) Experimental methods

Among the subjects who participated in this experiment, there were 9 athletes at the fitness level, 12 at the Division I level, and 9 at the Division II level. These 30 subjects were in good health and had years of training experience. According to the principles and requirements of the experimental design of this study, the 30 professional athletes who met the inclusion criteria were randomly ranked 1-30, and in through Excel software, the 30 professional athletes were randomly divided into two groups of 15 each, the experimental group and the control group, in a ratio of 1:1.

In the selection of subjects: this study selected a provincial team of professional athletes as the subject of experimental research, to ensure that they have many years of sports training experience. Selection of the experimental time: after full communication with the coaches of a provincial team, the experimental time was selected to start the experimental intervention study during the summer training of a provincial team in 2020, i.e. from April 4 to May 31, 2020, a total of 8 weeks, due to the heavy task of training during the summer training period of a provincial team, the intensity of preparation for the game is greater, so it is necessary to help athletes during the summer training period. Therefore, there is a need to help athletes during the summer training period due to training intensity and other factors arising from the problem of sports injuries, this study plans to arrange five days a week intervention relaxation training, relaxation time for the afternoon of every day after the training session, the experimental arrangements for the two groups of sports rehabilitation training, the control group in the traditional training room, while the experimental group is in the integration of sports rehabilitation functionalization of the training room. In the experimental intervention phase: In order to improve the effectiveness of intervention regulation in the experimental group, before each experimental intervention, a simple communication was conducted with the subjects, so that the subjects in the experimental group could eliminate distractions as soon as possible, and try to exclude other interfering factors without thinking about other things. In order to better understand the effect of sports rehabilitation functionalized residential, at the end of the experiment with the experimental group of athletes to communicate with the athletes in 8 weeks to understand the feelings of the athletes in the preliminary understanding of the effect, at the same time, questionnaire surveys, physiological and biochemical tests, and statistics of athletes in training data. Finally, the results of the two questionnaires and two index tests were further examined and unified into SPSS 22.0 to complete the data statistics, analysis and comparison.

IV. Analysis of case studies

IV. A. Recovery of biochemical indices after the experiment

IV. A. 1) Blood lactate recovery after the experiment

Lactic acid is actually a type of hydroxyl acid, which is produced by the glycolytic pathway in the case of insufficient oxygen supply. In the process of exercise training, lactic acid is generated mainly in the skeletal muscle, and then seeped through the cell membrane into the bloodstream, and eventually formed blood lactate, when the human body after exercise fatigue, there will be a drop in the maximum level of lactic acid in the body, in the human body after a certain load of exercise will be prolonged lactic acid clearance time phenomenon. In exercise load training, from time to time to determine the athlete's blood lactate can help us to understand the changes in lactate production and clearance in the body, as a basis for load training to control the intensity of the exercise load, the blood lactate recovery after the experiment is shown in Table 1. Lactic acid clearance is always carried out during and after exercise, and the main way of lactic acid elimination and the amount of conversion are different at different stages, and the rate of blood lactic acid clearance is also different. The T-test of the blood lactate values of the experimental and control groups before and immediately after training revealed that there was no significant difference in the blood lactate values of the athletes between the two groups (P=0.053, 0.068>0.05), which indicated that the blood lactate levels of the bodies of the athletes in the experimental group and the control group were the same, and that there was no significant difference in the lactate values measured in the immediate post-training period by the T-

test, and that the athletes of the experimental group and the control group could perform subsequent experiments at the same lactate The experimental group and the control group could carry out the subsequent experiments under the same lactate level. The experimental and control groups underwent relaxation after the intervention, respectively, and there was a significant difference (P=0.013<0.05) after T-test of the lactate test results of the athletes in the experimental and control groups. After 40 minutes after the end of relaxation was tested again, the experimental group group blood lactate value and the control group value after T-test, there is a significant difference between the experimental group and the control group (P=0.008<0.05), in the relaxation of the experimental group athletes 40 minutes after the return of blood lactate value to the normal level, while the control group did not get a good restoration, indicating that the functionalization of the function of sports rehabilitation function of the design of the residence of the professional athletes in biochemical indicators of blood lactate recovery effect has a promotional effect.

Table 1: The recovery of blood lactate after the experiment

Name	Before training		Immediately after training		Immediately after relaxation		40 minutes after relaxation	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Experimental group	3.562	0.144	3.941	0.317	1.819	0.263	1.644	0.249
Control group	3.583	0.151	3.925	0.323	3.532	0.257	3.225	0.243
N	15		15		15		15	
P	0.053		0.068		0.013		0.008	
T	4.412		2.189		1.287		3.213	

IV. A. 2) Creatine kinase recovery after the experiment

Post-exercise changes in serum creatine kinase can also be used to evaluate the functional status of athletes after exercise as well as to provide reference information for the development of exercise training programs. Serum creatine kinase values in athletes after intense or prolonged training and competition reach a maximum at 8 hours and generally return to normal levels in 40 min. Creatine kinase increased to 200-300 IU/L after intense strength training and 500-1000 IU/L during extreme intensity exercise. When the recovery rate was significantly slowed down or it took several days to return to normal level, it suggested that the athletes might be suffering from fatigue symptoms. Therefore, this study analyzed the creatine kinase values of athletes at different stages before and after the experiment, to explore whether the functionalized residential design of sports rehabilitation can help the recovery of creatine kinase after strength training, and the recovery of creatine kinase after the experiment is shown in Table 2. T-test was carried out on the creatine kinase level of the experimental group and the control group before training, and the creatine kinase values of the experimental group and the control group were tested to be not significantly different (P=0.059>0.05), and the creatine kinase of athletes in the experimental group and the control group was tested for a second time immediately after training, and T-test was carried out on the data obtained, and the results of the test were not significantly different (P=0.071>0.05), which shows that The body of the athletes in the experimental and control groups received the same load of stimulation after strength training, and also the effect of different experimental interventions on the recovery of creatine kinase can be further investigated after the experiment. Immediately after relaxation creatine kinase increased in all groups and t-test of the values reached by creatine kinase revealed a significant difference between the experimental and control groups (p=0.004<0.05), indicating that the effect of this article's approach on the recovery of creatine kinase in athletes after strength training is more significant compared to the traditional approach. The final test of creatine kinase of the experimental combination control group athletes was carried out 40 minutes after relaxation, and the test results showed that 40 minutes after relaxation the experimental group athletes' creatine kinase values were recovered, while the control group still had fatigue injury, and after the T-test of the experimental and control group athletes, it was found that there was a significant difference between the experimental and control groups (P=0.001<0.05), verifying that the Functionalized residential design for sports rehabilitation contributes to the recovery of creatine kinase after strength training in athletes.

Table 2: The recovery of creatine kinase after the experiment

Name	Before training		Immediately after training		Immediately after relaxation		40 minutes after relaxation	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Experimental group	544	13	922	39	203	9	235	8
Control group	551	17	918	31	871	28	917	32
N	15		15		15		15	

P	0.059	0.071	0.004	0.001
T	4.248	2.144	1.241	3.106

IV. B. Variability analysis of athletic performance

IV. B. 1) Analysis of Action Specification Test Results

With the help of statistical analysis software, the movement normality of athletes in the experimental group and the control group in different intervention modes was explored, and the results of movement normality test were analyzed as shown in Table 3. Before the intervention, the average score of the control group athletes in the movement normality test index was 1.63 points, and the standard deviation value was 0.42 points, and after the intervention, the average score of the control group athletes was 2.05 points, and the standard deviation value was 0.37 points, and the control group athletes showed a significant difference in the movement normality test index before and after the intervention (P=0.072>0.05). Before the intervention, the average score of the experimental group athletes in the movement normality road test index is 1.62 points, the standard deviation value is 0.38 points, after the intervention, the average score of the experimental group athletes is 3.37 points, the standard deviation value is 0.44 points, the experimental group athletes before and after the intervention of the movement normality test index appeared to have a very significant difference (P=0.001<0.01). It can be seen that before the intervention, there is no significant difference between the athletes of the control group and the experimental group in the movement normality test indexes, so the follow-up experimental research can be carried out, and after the intervention, the athletes of the experimental group have significant differences in the movement normality test indexes, while the control group does not have any significant differences, but in terms of the extent of the increase, the degree of increase of the athletes in the control group is 0.56, and the degree of increase of the athletes in the experimental group is 1.08. However, in terms of the degree of increase, the degree of increase in the control group was 0.56, and the degree of increase in the experimental group was 1.08%, and the degree of increase in the experimental group increased significantly, which indicates that compared with the traditional way, the effect of this paper's intervention on the improvement of movement standardization of professional athletes is particularly obvious.

Table 3: Analysis of the test results of action standardization

Name	N	Before		After		P	Degree of increase
		Mean	SD	Mean	SD		
Control group	15	1.63	0.42	2.05	0.37	0.072	0.56
Experimental group	15	1.62	0.38	3.37	0.44	0.001	1.08
P		0.083		0.006		/	/

IV. B. 2) Results of the motor explosive force test

Using the same method as above, the athletic explosive power of the experimental group and the control group athletes in different interventions were analyzed differently, and the results of the athletic explosive power test were analyzed as shown in Table 4. Before the experimental intervention, the mean value of the athletic explosive force of the experimental group athletes was 2.05, and the mean value of the athletic explosive force of the control group athletes was 2.01, which shows that before the experimental intervention, after the t-test of independent samples concluded that there is no significant difference between the two groups in the test results of athletic explosive force (P=0.099>0.05), and subsequent experimental interventions can be carried out; after experimental intervention, the mean value of the experimental group The mean value of athletic explosive strength of the athletes was 4.14, and the athletes in the control group were 2.99. The results of the paired samples t-test showed that before and after the intervention, the P=0.052>0.05 for the control group and the P=0.002<0.01 for the experimental group, and there were statistically significant differences in the results of the two groups after the intervention, and the results of the independent samples t-test after the intervention showed that the P=0.001<0.01 for the experimental group and the control group. 0.001<0.01, and the increase in sports explosive power of the experimental group (1.01) was significantly greater than that of the control group (0.049), which led to the conclusion that, compared with the traditional way, the functionalized residential design of sports rehabilitation has a particularly prominent effect on the recovery of sports explosive power of athletes, which well verifies the effectiveness of the research program of this paper.

Table 4: Test results of explosive power in sports

Name	N	Before		After		P	Degree of increase
		Mean	SD	Mean	SD		

Control group	15	2.01	0.27	2.99	0.31	0.052	0.49
Experimental group	15	2.05	0.25	4.14	0.39	0.002	1.01
P		0.099		0.001		/	/

IV. C. Differential analysis of psychological status

IV. C. 1) Pre-intervention comparative analysis

Before the experiment, the psychological condition of professional athletes in the experimental and control groups was tested. The results of the analysis are shown in Table 5: there is no significant difference between the two groups of athletes before the experiment in the total score of the psychological condition of athletes (p=0.394>0.05); there is also no significant difference in the scores of the three dimensions of the psychological condition of professional athletes: reduced sense of accomplishment, emotional/physical exhaustion, and negative evaluation of the sport (p=0.484, 0.359, 0.343>0.05). This indicates that the degree of psychological condition of the athletes in the two groups before the experiment was basically the same. Of the three dimensions of sport psychological fatigue, the most prominent in professional athletes was emotional/physical exhaustion, followed closely by a reduced sense of accomplishment, and lastly, negative evaluation of the sport. Professional athletes' training programs belong to the physical dominance category endurance item group, which requires high levels of specialized speed and endurance. In this study, professional athletes had to complete a large amount of training every day, and the intensity of the sport was also high, coupled with the need to complete the theoretical knowledge of the sport in addition to the training, the double pressure is likely to increase the emotional/physical exhaustion of professional athletes, which affects the training effect and the acquisition of the sense of achievement, and deepens the degree of the psychological condition of the sport.

Table 5: Comparative analysis before intervention

Name	N	Experimental group		Control group		P-Value	T-Value
		Mean	SD	Mean	SD		
The reduction of a sense of achievement	15	2.45	0.13	2.46	0.11	0.484	2.005
Emotional/physical exhaustion	15	2.33	0.18	2.48	0.17	0.359	1.429
Negative evaluation of sports	15	2.47	0.14	2.43	0.15	0.343	0.884
Total score	15	7.25	0.45	7.37	0.43	0.394	0.627

IV. C. 2) Comparative post-intervention analysis

There was no significant difference in the psychological condition of the two groups of athletes in the pre-test (p=0.394), which ensures that the effect of the intervention did not come from the differences that existed between the two groups themselves, and the results of the post-intervention comparison were analyzed as shown in Table 6. After a period of experimental intervention, it was found that there was a significant difference between the control group and the experimental group in the reduction of the sense of accomplishment, emotional/physical exhaustion, and the negative evaluation of exercise. After the intervention of professional athletes using the methods of this paper, the sense of achievement and positive experience in the field of sports were increased, the degree of emotional depletion and negative evaluation of sports were reduced, the formation of harmonious interpersonal relationships among athletes was promoted, and the psychological condition of professional athletes was effectively alleviated, which fully proved the repairing effect of the functionalized residential design of sports rehabilitation on the psychological state of professional athletes.

Table 6: Analysis of the comparison results after the intervention

Name	N	Experimental group		Control group		P-Value	T-Value
		Mean	SD	Mean	SD		
The reduction of a sense of achievement	15	1.51	0.22	2.72	0.16	0.001	1.045
Emotional/physical exhaustion	15	1.42	0.24	2.76	0.19	0.005	1.224
Negative evaluation of sports	15	1.36	0.25	2.81	0.21	0.004	0.524
Total score	15	4.29	0.71	8.29	0.43	0.002	0.317

V. Conclusion

Through an 8-week experimental intervention with 30 professional athletes, the study found that the functionalized residential design of sports rehabilitation significantly promoted the athletes' post-injury recovery. The experimental group was better than the control group in the recovery of blood lactate and creatine kinase, specifically, the

experimental group's blood lactate value recovered to the normal level 40 minutes after relaxation, while the control group's recovery was unsatisfactory, with a P value of 0.013 and 0.008, respectively; the recovery of creatine kinase also showed a clear advantage, with the experimental group's creatine kinase value recovering to the normal level 40 minutes after relaxation, while the control group's recovery failed to be effective, with a P value of 0.013 and 0.008, respectively. In addition, the increase in explosive power of the experimental group was 1.01, which was significantly higher than that of the control group (0.49), with a p-value of 0.002, indicating that the functionalized residential design could enhance the athletes' performance more effectively.

In terms of psychological conditions, the experimental group showed significant improvements in athletes' sense of achievement, emotional/physical exhaustion and negative evaluation of exercise, with P values of 0.001, 0.005 and 0.004, respectively. Overall, functionalized residential design not only accelerated athletes' physiological recovery, but also positively contributed to psychological health by optimizing the sports rehabilitation environment. These research results provide an important theoretical basis and practical guidance for the application of functionalized residential design for sports rehabilitation, further proving its practical value in the post-injury recovery of professional athletes.

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