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# Research on the Influence of Heavy Load Training on Wushu Athletes' Gait Based on Strategic Management

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## Abstract

**The plantar pressure is the pressure distribution between the plantar and the supporting surface, and the ground reaction force is the ground reaction force that the human body receives during the movement, which is the result of the combined action of plantar pressure and shear force. Normal gait refers to the gait when a healthy adult walks with the most natural and comfortable posture. With the continuous improvement of Wushu athletes' technical level, in order to further strengthen the training effect and achieve excellent results, Wushu athletes have been bearing a large load for a long time. Sports fatigue can not only cause the decline of athletes' ability, but also lead to sports diseases and sports injuries. Based on the strategic management method of sports training, this paper analyzes the gait characteristics of Wushu Athletes in sports training, and discusses the influence of Wushu athletes on foot bones after heavy load training. In order to improve Wushu sports training, improve the competitive ability of athletes and improve the health of athletes to provide help.**

## Keywords

**Gait; Wushu athletes; Load.**

## 1. Introduction

With the continuous improvement of Wushu athletes' technical level, in order to further strengthen the training effect and achieve excellent results, Wushu athletes have been bearing a large load for a long time, which is easy to make athletes' feet produce sports fatigue and difficult to recover [1]. Normal gait refers to the gait when a healthy adult walks with the most natural and comfortable posture. Teachers and coaches adopt the training methods of high intensity, large amount of exercise, difficulty and severity to improve the level of special training. For most athletes, sports injuries are inevitable. If Wushu athletes insist on training with injuries, they will be easily troubled by injuries, making it difficult for them to improve their technical level [2]. After long-term training, the gait of athletes has significant changes compared with that of ordinary people. An excellent Wushu athlete should have good physical quality and control of gait. On the basis of understanding the mechanism of Wushu athletes' sports fatigue, scientifically applying physiological and biochemical indexes to assess the degree of sports fatigue in Wushu training plays a positive role in scientifically adjusting Wushu athletes' competitive state, reasonably arranging sports training load and preventing overtraining and sports injury [3]. Studying the gait and sole force characteristics of Wushu athletes has important guiding significance for improving athletic performance and reducing the incidence of sports injuries.

Wushu is a power endurance project that needs to overcome its own weight. It has high requirements on athletes' strength, speed, dexterity, balance and gait control [4]. How to recover from fatigue faster and better has not been better addressed. Wushu training is a complex and scientific diversified project. Fatigue and recovery determine the success or failure

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of training [5]. Only by understanding the mechanism of fatigue, the recovery process and recovery method of the body can we effectively improve the performance and extend the life of the exercise [6]. Wushu exercises are fiercely combative, with a high concentration of attention and a large proportion of energy consumption. At the same time, large energy losses and increased lactic acid. Increased lactic acid and reduced glycogen can cause central fatigue. The improvement of athletes' performance level is caused by moderate exercise fatigue caused by training, and reasonable recovery is performed, so that the human body's functional status can obtain adaptive results at a new level [7]. The process of fatigue and recovery is an indispensable part of training, and reasonable adjustment of gait is an important guarantee to improve training level and physical function level [8]. Exercise fatigue can not only cause athletes' physical decline, but also cause sports diseases and sports injuries [9]. In this paper, by analyzing the gait characteristics of Wushu athletes during heavy-load training, a method of targeted elimination of Wushu sports fatigue is proposed. With a view to improve Wushu sports training, improve the athlete's athletic ability and provide athletes' health.

## 2. Gait Characteristics of Wushu Athletes under Heavy Load Training

During Wushu training, the diagnosis of gait characteristics is completed by coaches and athletes in coordination. It is an important part of the scientific training plan to select an appropriate, simple and easy method to scientifically diagnose the occurrence and degree of fatigue of Wushu athletes. Nutrition is the material basis for the recovery of consumed substances after exercise, and sugar is the main energy substance during exercise. Wushu repeatedly attacked with his legs. When landing, if the center of gravity is unstable, leans to one side or steps on another's foot, it will land on the front and outside of the foot and turn inward, resulting in damage to the lateral collateral ligament. In this kind of injury, the anterior talofibular ligament is the most vulnerable. If the strength is greater, the calcaneal ligament will be injured one after another. If the external force of injury continues to increase, the interosseous ligament between the calcaneal and talofibular joints will be injured at the same time. There are a lot of running and jumping exercises in Wushu sports, so before, during and after the sports, it is undoubtedly a promoting factor to improve the sports ability of Wushu athletes to add more carbohydrate substances, starch and other high-energy substances. The energy and materials consumed during training are gradually recovered after the exercise, and the recovery is good or even excessive. During the training, the internal environment and the balance of nervous, immune and endocrine systems were destroyed. During the recovery period, it should be recovered as soon as possible and as well as possible to improve the body's adjustment ability. As shown in Figure 1, the level classification is defined for injuries in Wushu training.

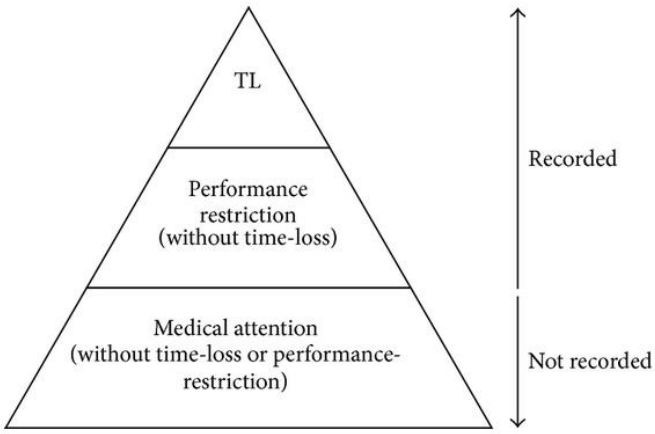


**Figure 1.** Classification of damage definition levels in Wushu training

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Athletes should strictly abide by the prescribed work and rest system and pay attention to food hygiene. Create good sleep conditions to improve sleep quality. Overcome bad habits such as smoking and drinking. Due to the particularity of Wushu, the athletes' performance is relatively early, their age is small, their world outlook has not yet been fully formed, and their ability to analyze and solve problems is still relatively immature. To help athletes objectively and realistically analyze various factors and establish reasonable long-term and short-term training objectives. It is helpful to improve the athletes' ideological level. It can also eliminate psychological fatigue caused by unrealized expectations. During training, Wushu athletes' lactic acid production lowers the pH value of muscles, inhibits the activity of phosphofructokinase, a key enzyme in sugar metabolism, and hinders the energy supply of glycolysis metabolism. At the same time, ammonia production in blood and tissues affects muscle working ability, and muscle spasm occurs when ammonia production increases in brain tissues.

## 3. Impact Analysis of Athletes' Gait Based on Biological Characteristics

Human body movement is the result of the whole body and requires the active cooperation of bones, muscles, joints and other parts to complete the normal movement process. The lower limbs of the human body are an important part of supporting the human body and ensuring the completion of upright walking, and the lack of lower limb muscle strength will affect the normal gait of the human body. The connection between bone and bone is called bone connection. Bone connection can be divided into direct connection and indirect connection. Direct connection refers to the interconnection through connective tissue, cartilage or bone between bone and bone. There is no gap between the connections, and the range of motion is very small or completely unable to move. The degree of freedom can usually be ignored in the establishment of human kinematics model. Indirect connection is also called joint. Joint is connected with ligament through joint capsule and usually has greater activity. Changes in bone metabolism can often reflect the activities of osteoblasts and osteoclasts, metabolic changes of bone organic matter and bone minerals [10]. In the training, we can change the content of the exercise, adjust the load of the training and change the position of the exercise to rest. Before and after the changes of bone mass, bone density and bone ultrastructure, the changes of biochemical markers in bone metabolism will inevitably be accompanied, which provides noninvasive, sensitive and specific biochemical detection means for the evaluation of the effect of physical exercise in training and the early prevention, detection and treatment of osteoporosis in medicine.

Based on physiology and anatomy, the gait characteristics of human body are studied by using the related principles of dynamics, statics and kinematics. Because of the complexity of human structure and the particularity of human function, it is very difficult to describe human motion and reveal its mechanism. If the mass distribution of each rigid body is assumed to be uniform, the inertial parameters of the rigid body required in Table 2 can be calculated by using the inertial parameters obtained in Table 1. The rotating inertia index of different parts is shown in Figure 1.

**Table 1.** Inertial parameters of each part of the experimenter's body

| Place | Mass (kg) | Moment of inertia |
|---|---|---|
| Foot | 0.83 | 121.34 |
| Calf | 3.17 | 210.52 |
| Thighs | 9.86 | 243.96 |
| Trunk | 32.12 | 3346.78 |
| Neck | 7.51 | 291.45 |

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**Table 2.** Inertia parameters of each rigid body

| Place | Mass (kg) | Moment of inertia |
|---|---|---|
| Toe | 0.27 | 52.15 |
| Supporting side calf | 2.47 | 269.12 |
| Swinging side calf | 2.47 | 269.12 |
| Supporting side thigh | 9.36 | 378.56 |
| Swinging side thigh | 9.36 | 378.56 |

During Wushu's heavy exercise training, excessive fat in the body was mobilized and free fatty acid in blood increased significantly. The contribution of work done by each joint to the work done by the lower limbs increases with external load. The contribution of hip joint gradually increases while that of knee joint gradually decreases. There was no significant difference in ankle joint contribution under various weight-bearing conditions. There is no linear relationship between the contribution of the three joints and the load, and the contribution does not increase or decrease linearly with the increase of the load. As shown in Figure 2.

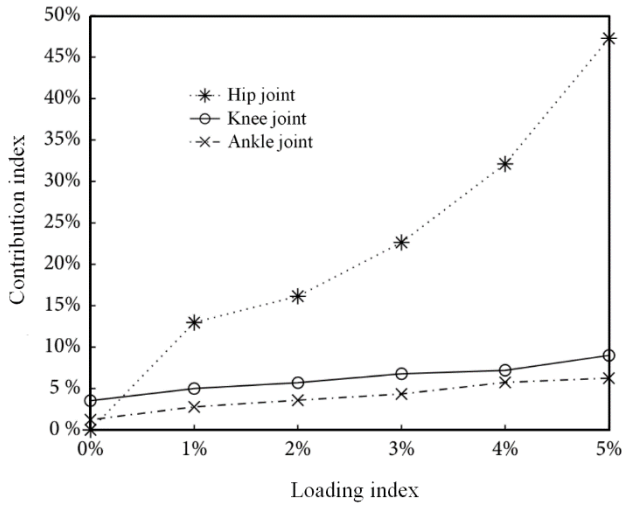


**Figure 2.** Contribution and weight-bearing data of three joints

During Wushu's training, the application of biochemical indexes is an important means to scientifically formulate training plans, master appropriate intensity, evaluate training effects and diagnose functional fatigue. As an important supporting system of human body, foot bone microstructure deterioration will increase the risk of fracture. One of the effective defensive measures is to continuously form beneficial stimulation to bones through appropriate exercise so as to increase bone mass and achieve the purpose of improving bone tissue health. A regular living system can ensure the elimination of fatigue after exercise. Different treatment should be made in the load arrangement of training classes. Every Wushu athlete has his own characteristics, so in the training class, he should choose all-round training methods and methods suitable for his own characteristics. In the course of training, interval time should be arranged reasonably and training methods and contents should be changed frequently. Judging from Wushu's training, the basic skills account for a large proportion in the training. Every skill of the athletes needs tens of millions of repetitions to finalize the design and establish a good proprioceptive feeling. Fatigue in Wushu exercise training is closely related to exercise training load, cardiac function, oxygen consumption, accumulation of metabolites and other factors. Coaches should consciously impart this knowledge to athletes so that the training can be carried out normally, orderly and continuously.

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## 4. Conclusion

In order to improve the physical health of Wushu athletes and improve their competitive level, this paper analyzes the gait characteristics of Wushu athletes so that coaches and athletes can understand the symptoms of fatigue at any time during training. With the development of modern competitive Wushu sports, the number of matches is increasing, and the difficulty and height of movements are increasing and improving. Wushu athletes have to bear more and more load in sports training. The foot bears repeated load every day or exercises for a long time, which may cause damages or minor damages that can only be found under a microscope. The impulse distribution in forefoot, phalange region and middle part of foot is larger, while the heel region is the smallest when athletes are carrying out heavy load exercise training. The results showed that the main parts of dynamic load were forefoot inner, lateral and midfoot, and the contribution of heel to body speed was the least. Combined with the analysis of the results of lower limb kinematics of athletes and ordinary people, these characteristics may reflect the technical characteristics of Excellent Wushu athletes. In the specific practical operation process, we can choose appropriate measures and means to cooperate with the application according to the specific physiological function and training intensity of Wushu athletes. In order to ensure the healthy development of physical and sports training of the athletes and improve the sports ability of Wushu athletes as soon as possible.

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