Scholar Publishing Group
International Journal of Sports Technology
https://doi.org/ 10.38007/IJST.2020.010105
ISSN 2789-7141 Vol. 1, Issue 1: 60-71

Changes of Renal Morphology and Function in Rats with Muscle Injury after Induced Skeletal Exercise

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Keywords: Induced Skeletal Movement, Skeletal Muscle Injury, Renal Morphology in Rats, Kidney Diseases

Abstract: Chronic kidney disease is a progressive disease characterized by chronic renal failure, which can lead to end-stage renal disease over time. Lipid metabolism disorder is a common disease in patients with chronic kidney disease. Lipid can directly or indirectly enhance the progress of renal damage through direct renal cytotoxicity or promoting renal arteriosclerosis. Therefore, it is of great significance to explore the research progress of renal morphology and function in rats with muscle injury induced by skeletal exercise. The purpose of this study is to explore the degree of renal injury and the changes of renal morphology and function after bone exercise, and to find out the relationship between them. In this study, four groups of experimental subjects were set up, which were blank control group, 12-hour exercise group, 24-hour exercise group and 48-hour exercise group. The results showed that the serum uric acid value of the rats after 48 hours of exercise was the highest, reaching 348.1 umol / L, while the serum creatinine index of the blank control group was the highest, which was 112.4 umol / L, which decreased with the increase of exercise time. The highest value of serum urea nitrogen in the blank control group was 5.53 mmol / L. The weight of rats decreased with the increase of exercise time, and the weight loss of rats after 48 hours of exercise was 6.1g. In the quantitative measurement of urinary protein, we can draw such a conclusion that the longer the exercise time, the higher the content of urinary protein, and with the passage of time, the content of urinary protein will return to the normal range, and the measurement results of red blood cell number also increase with the increase of exercise time.

1. Introduction

1.1. Background and Significance

Kidney is an important secretory organ of human body. Its main function is to secrete metabolites, regulate water, electrolyte and acid-base balance, which plays an important role in maintaining the stability of human environment. By measuring the renal blood flow, we can evaluate the renal hemodynamics and renal function, which is of great clinical significance in the diagnosis of the disease, the judgment of the prognosis crisis and the evaluation of curative effect. The commonly used methods of renal function evaluation include glomerular filtration rate, ultrasound, CT perfusion scan, MR perfusion and other imaging methods. Laboratory examination cannot reflect unilateral renal function. The commonly used measurement of serum creatinine is also affected by muscle volume, renal tubular excretion and measurement errors, and changes in laboratory tests are usually due to the combined effects of renal hemodynamics and renal function. Therefore, renal blood flow cannot be directly reflected, so it is particularly important to explore the changes of renal morphology and function.

1.2. Related Work

In adult patients with diabetes and nephropathy, the efficacy and safety of antihypertensive drugs are still controversial. Zhou's aim is to investigate the benefits and hazards of antihypertensive drugs for these patients. Zhou conducted a web-based meta-analysis of randomized trials from around the world to compare antihypertensive drugs in patients with diabetic nephropathy. As of January 2014, a systematic search of the electronic databases (Cochrane Collaboration, MEDLINE and EMBASE) was conducted to compare oral antihypertensive drugs in adults with diabetes and nephropathy. Zhou also evaluated the secondary safety and cardiovascular outcomes, conducted a random effects network meta-analysis to obtain estimates of primary and secondary outcomes, and finally used these estimates as the odds ratio or standardized mean deviation of 95% confidence interval [1].

Phthalimide diphenyl ether sulfone copolymer (ppbes) is a kind of poly (aryl ether) which can be bought in the market. Its mechanical properties are similar to bone, so it is a promising orthopedic implant material. However, the bio inert surface of poly (aryl ether) will cause some clinical problems after implantation, which limits its application as implant materials. Chengde modified the surface of ppbes by biomineralization of poly (dopamine) - assisted hydroxyapatite (PHAF) to enhance its cytocompatibility. Inspired by the adhesion mechanism of mussels, polydopamine (PDA) coating can easily give ppbes high hydrophilicity and the ability to integrate through bone like apatite coating. Chengde evaluated ppbes and PDA coating ppbes by scanning electron microscopy (SEM), X-ray photoelectron spectroscopy (XPS) and contact angle measurement [2].

In order to investigate the effects of formaldehyde (FA) exposure on fetal liver and kidney morphology during pregnancy, and to explore the protective effect of chrysin (CH) on these damages. Yi randomly divided 58 female rats into 6 groups. Rats in group I were intraperitoneally injected with serum physiology (SF), group II with CH 20 mg / kg, group III with FA 0.1 mg / kg, group IV with FA 1 mg / kg, group V with CH 20 mg / kg and group 6 with FA 1 mg / kg. One pregnant rat was selected for cesarean section on the 20th day of pregnancy. Morphological analysis of fetus, liver and kidney, biochemical and histological analysis of liver and kidney were carried out [3].

1.3. Innovation

In the experiment, in order to avoid the damage of renal function, renal artery ischemia time and renal artery and vein ischemia time at room temperature should be checked within 20 minutes, and more than 30 minutes can cause renal function damage. The conclusion is that the longer the exercise time, the more serious the kidney damage, but with the extension of rest time, the kidney will be recovered.

2. Changes of Renal Morphology and Motor Function

2.1. Acute Kidney Injury

Acutekidneyinjury (Ard) is a syndrome that causes rapid decline in renal function due to various clinical manifestations. It may include multiple organs and systems. Incidence rate is 4%-20% in hospital patients, while in ICU, the morbidity rate in ICU is 30%, and the mortality rate is over 50%. This phenomenon caused by acute kidney injury has become a global medical and social problem. Investigation shows that about 30% of complex acute kidney damage has potential kidney disease, 25.6% secondary to baseline, 34.3% after major surgery, 47.5% with complications after septic shock, 26.9% with cardiac shock and 19% with drug-induced renal damage [4]. Compared with acute renal failure, the complex acute renal damage highlights the importance of early diagnosis and timely treatment of the syndrome. In recent years, it has been widely used and recognized by the medical community.

Acute renal damage includes prenatal nitrite, idiopathic acute renal failure and acute tubular necrosis. Aki was described as early as ancient Greece, but there was no index of modern medicine at that time, and the diagnosis was only based on "reduced urine volume". With the development of pathology and biochemistry, modern medicine has entered a period of great development. At the same time, the concept of acute kidney damage has also developed, such as crush injury, war nephritis, and falciparum malaria [5]. The article on acute glomerulonephritis describes the causes of acute kidney damage, such as decay, pregnancy and burn toxins, and introduces serum creatinine as a diagnostic indicator. Next, relevant staff have begun to carry out epidemiological research on acute renal impairment, and distinguish the serum creatinine index of patients with chronic kidney disease from that of patients with non-kidney disease. In clinical research, in addition to the use of serum creatinine index, blood urea nitrogen can also be used as a diagnostic report. The causes of acute renal injury include nephrotoxic drugs, heart disease, acute tubular necrotizing hypotension, acute renal necrotizing sepsis and liver disease.

2.2. Injury Caused by Induced Bone Movement

Exhaustive exercise can lead to renal tissue paralysis and hypoxia, the support for free radicals is relatively insufficient, and the free radical scavenging ability is poor, which will lead to the changes of glomerular filtration membrane and renal tubule ultrastructure, and damage the function. The effect of acute exhaustion exercise on the structure of renal cells in rats is mainly manifested in renal tubules [6]. During exhaustive exercise, the blood in the body redistributes and the renal blood flow decreases rapidly, resulting in renal ischemia and hypoxia. After exhaustive exercise, the renal blood flow gradually recovered, which led to renal ischemia-reperfusion. The increase of free radicals leads to the increase of cell membrane permeability and the decrease of fluid. The effect of high intensity exercise on the structure of rat kidney cells may be due to the formation of "ischemia-reperfusion" in the kidney under intense exercise, and then under the scavenging effect of xanthine oxidase, a large amount of oxygen oxidizes hypoxanthine root without producing peroxides, which may be caused by free radicals and unsaturated fatty acids in membrane structure Peroxidation, which destroys the structure of cell membrane and leads to further apoptosis [7].

Skeletal muscle injury (SMI) refers to the changes of metabolism, histochemistry, morphological structure and function of cells and intercellular substance after being stimulated by intolerable harmful factors, which eventually leads to functional limitation or dysfunction. SMI is the most common soft tissue injury, accounting for the largest proportion of muscle injury, mainly manifested as muscle acid swelling and stiffness, lack of contraction and relaxation capacity. According to the location of the injury, it can be divided into the injury of complete rupture of muscle fiber and muscle connective tissue, and the injury of muscle in situ with only muscle fiber injury but normal connective tissue. It includes abdominal muscle injury, tendon injury and skeletal muscle auxiliary structure injury. According to the causes of injury, it can be divided into sports skeletal muscle injury and non-exercise skeletal muscle injury. Exercise-induced skeletal muscle injury refers to the structural and functional damage of skeletal muscle caused by exercise (especially eccentric exercise); non exercise injury is caused by non-exercise factors. Skeletal muscle injuries in sports are mostly mild and moderate injuries, while severe injuries are common in muscle strain and fracture caused by external violence. According to the severity of injury, it can be divided into acute injury caused by one-time instantaneous violence, chronic injury caused by long-time local overload exceeding the bearing capacity of tissue, or chronic injury accumulated by multiple micro damage.

2.3. Automatic Diagnosis Method of Lesion Detection

Damage detection based on CAD system is an important research topic in the field of medical image processing and analysis. Early detection in the condition and severity of the disease is helpful to improve the effectiveness of diagnosis and treatment. At present, correlation imaging technology has been widely used in the judgment and identification of lesions, evaluation of therapeutic effect and prediction of hazard development trend [8].

The automatic diagnosis method of lesion detection uses the PET image tumor detection framework, and involves the classification algorithm of heart, left and right lung, liver, background, tumor and other tissue regions in human chest image. Based on the gray level co-occurrence table, the feature range of classification samples is mainly composed of eight second-order texture features, which constitute the intrinsic standard uptake value of PET image. By extracting the statistical information of features, the samples of regions of interest in different patient images are sent to the sort of logical enhancement to learn and train to obtain the corresponding classification system [9]. Before testing the sample, SUV threshold is used to limit the gray range, and the interference of image noise is eliminated by connecting with the analysis element and the improved method.

In order to better manage and monitor CT images of renal cell carcinoma, a computer-aided clinical diagnosis tool is needed for evaluation and classification. In the quantum process, the level and shape decision statistics are used for semi-automatic segmentation of the kidney tumor region in the enhanced scanning image, so as to collect the size and volume of the lesions. The shape of the lesions may be affected by the location of the kidney, the intensity of the volume and the characteristics of the tissue environment. The histogram (HCF) distribution of the correlation features of the random sampling curve was proposed and used as the basis for the classification of kidney diseases. The selection of this classification scheme is mainly based on the shape distribution inside the fault and the CT value information of multiple imaging scanning steps [10]. In order to facilitate the calculation, the main method of component analysis is used to reduce the dimension of HCF after the output features.

2.4. Partial Renal Blood Flow Occlusion

Skeletal muscle is an organ with strong energy metabolism, which produces energy to maintain body posture and exercise process. Adenosine triphosphate (ATP) synthesis in skeletal muscle mitochondria can not only maintain people's daily physical activity and competition needs, but also play a key role in regulating the overall stability of the human body. Skeletal muscle mitochondria cause various environmental acute and chronic stress remodeling changes to maintain cell homogeneity, and the enhancement of mitochondrial biosynthesis is a common response to exercise.

The biosynthesis of mitochondria is not a whole process of assembling from scratch, but lipid, protein, mitochondrial DNA and other components of mitochondria continue to form in the existing mitochondria, realizing the increase of mitochondrial materials, and then achieving the quantitative growth through mitochondrion Division [11]. Whether one-time exercise or long-term exercise training can improve the level of mitochondrial biosynthesis of skeletal muscle, which is conducive to energy composition. Generally, it is decided whether to control the renal pedicle according to the size of the kidney. For large tumors (4 cm in diameter) undergoing LNSS, it is necessary to clamp the renal pedicle to help stop bleeding. When the thickness of renal parenchyma is less than 1 cm between tumor and collecting system, it is necessary to clamp the renal pedicle to provide a good visual field to repair the possible damage of collecting system. In addition to the overall clamping of the renal pedicle to control the renal blood flow, there is also the method of only blocking the renal artery blood flow and opening the renal vein, and the double ring clamp device is used to temporarily block the renal artery [12].

Partial inhibition of renal blood flow refers to the use of tools to compress renal parenchyma to achieve the purpose of local blood flow inhibition. The method includes using tie knot tourniquet and double ring tourniquet

(1) Tie a tourniquet. The tumor was located in the upper pole of the kidney with a diameter of 3cm. After the tumor was exposed, a 10 inch long and 1 / 4 inch wide sterilized tie knot was made into a ring, which was bound to the upper pole of the kidney (under the tumor and above the renal pedicle), and then the tie knot was tightened to make the upper pole of the kidney ischemia and easy to remove the tumor. The hemostasis of tie cord is limited to the tumors in the upper or lower pole of the kidney. The clinical reliability of the tie cord hemostasis for other tumors is still worth studying.

(2) Double ring tourniquet. The tourniquet is made of a 1 / 8 inch wide U-shaped plastic band, which is also designed to produce regional ischemia and minimize warm ischemic damage to the kidney. The double ring tourniquet was placed in the upper and lower pole of the kidney. The inner circle compressed the renal parenchyma, which could control the regional blood flow at any time. In the one pole containing the tumor, the tourniquet is tightened to cause surface compression to block blood flow, and then the tumor is removed. During the operation, the tourniquet should not only be too tight to cut the renal parenchyma, but also prevent the tourniquet from being too loose and sliding.

3. Experimental Study on Renal Morphology and Function of Rats with Muscle Injury Induced by Skeletal Exercise

3.1. Experimental Setup

Forty 6-week-old clean grade Wistar rats, half male and half female, weighing about 195g were used as experimental animals. The rats were randomly divided into blank control group, 12-hour exercise group, 24-hour exercise group and 48-hour exercise group. All rats were fed with routine diet. In the exercise experiment, different exercise time was taken, and treadmill exercise was performed in the exercise group, according to the cumulative way of exercise time, rats in 12 hour group need to exercise 1.2 hours a day in 10 days, 24-hour rats need to exercise 2.4 hours a day in 10 days, and 48 hour rats need to exercise 4.8 hours a day in 10 days.

3.2. Experimental Steps

Blood samples were collected by heart blood collection method and sent to the Second Affiliated Hospital of our college of traditional Chinese medicine for biochemical analysis and detection, so as to detect the biochemical indicators related to the kidney; the kidney tissue was cut and fixed with 5% formaldehyde solution for 36h; the tissue block was trimmed and cleaned, then dehydrated by gradient alcohol, transparent with xylene, soaked in wax, and embedded in conventional paraffin, The thickness of tissue section was 6 μ m, he staining and light microscope observation. To determine the total amount of urine protein, the blood sample should be added into the urine proteinase of 1mg / ml rats and stirred for 36h at room temperature. The pepsin of rats was used as the control group. After neutralizing HCl, the urine protein content was measured by BCA kit, and the total urinary protein content was determined by subtracting the urinary protease content.

After the experiment, we also need to observe the general situation of rats in each group, including the following:

(1) Skin and fur: the purity of fur color, whether fluffy, turbid, etc.

(2) Nervous and motor system: including mental state and response to external stimuli, such as irritability, increased activity, allergic reaction, active gait, quiet, reduced activity, no response, drowsiness or coma, etc. Muscle contraction, constipation, relaxation, paralysis, lying down, etc. Eye secretions (pupil opening or narrowing significantly), tears, salivation, perineum clean or not [13-14].

(3) Respiratory and cardiovascular aspects: respiratory type, respiratory rate, respiratory rhythm, nasal secretions increase and decrease, arrhythmia in the anterior area of heart rate. Gastrointestinal diseases: changes in diet, dietary habits, stool characteristics and color changes, abdominal arch or herpes, flatulence or not[15-16].

(4) Body weight changes, changes in general blood conditions related to renal function, and biochemical indicators related to renal function, such as urea nitrogen, creatinine, uric acid, urinary protein and red blood cells.

3.3. Statistical Methods

Statistical processing data processing using computer software for statistical analysis. The measurement data were expressed as mean ± standard deviation. The comparison of normal distribution measurement data between groups was conducted by one-way ANOVA, and the comparison of skew distribution data between groups was conducted by rank sum test. The difference was statistically significant ($P < 0.05$) [17]. The formula of skew distribution is as follows:

Suppose that the random variable X=(X1,...,Xn),Xi obeys the partial normal distribution SN(μ,σ2,c), and the density function is:

$$f(x;\mu,\sigma^2,c)=\begin{cases}\frac{c}{\sqrt{2\pi}\sigma}e^{\frac{-(x-\mu)^2}{2\sigma^2}}, & x\le\mu\\ \frac{2-c}{\sqrt{2\pi}\sigma}e^{\frac{-(x-\mu)^2}{2\sigma^2}}, & x>\mu\end{cases} \quad (1)$$

When c = 1, the partial normal distribution is the standard normal distribution, which is a special case of partial normal distribution. The density function is as follows:

$$f(x)=\frac{1}{\sqrt{2\pi}\sigma}e^{\frac{-(x-\mu)^2}{2\sigma^2}},-\infty<x<\infty \quad (2)$$

4. Experimental Analysis of Renal Morphology and Function in Rats with Muscle Injury after Induced Skeletal Exercise

4.1. Comparison of Biochemical Indexes of Renal Function in Rats

The rats in the blank control group had smooth fur, smooth breathing, quick reaction, normal food intake and stool, and strong physique; after 48 hours of exercise, the rats in the control group had different degrees of shortness of breath, stiff mind, salivation on the mandible, slow reaction, crawling and slow movement, which could be gradually alleviated and disappeared after 6 hours' rest, After 24 hours of exercise, the above similar reactions were not obvious or did not appear in the rats in the exercise for 12 hours group. After exercise, the biochemical indexes related to renal function of rats measured after exercise showed no significant difference among the groups, as shown in Table 1.

Table 1. Biochemical indexes of renal function

Group	Serum urea nitrogen(mmol/l)	Serum creatinine(umol/l)	Serum uric acid(umol/l)
Control group	5.53	112.4	326.4
Exercise for 12 hours	5.82	98.5	339.2
Exercise for 24 hours	5.71	104.3	332.7
Exercise for 48 hours	5.51	110.9	328.5

The data in the table can be seen that the mean value of serum urea nitrogen, serum creatinine and uric acid in the blank control group were 5.53mmol/l, 112.4umol/l and 326.4umol/l respectively. However, the values of three biochemical indexes of renal function of rats with muscle injury after long-term muscle injury were increased or decreased when skeletal movement was different. In order to see the change trend of the three values more conveniently, a column chart was made.

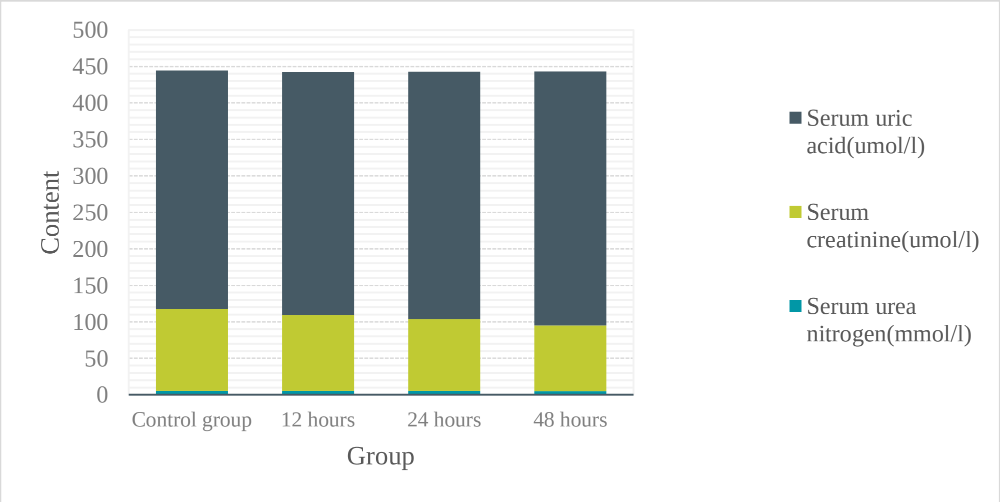

Figure 1. Changes of biochemical indexes of renal function

As shown in Figure 1, the highest biochemical index value is serum uric acid, and its change trend is also the biggest fluctuation. The serum uric acid index value of muscle injury rats after induced skeletal exercise for 12 hours to the serum uric acid index value for 48 hours of exercise increased from 332.7 to 348.1, with a rapid increase speed. However, the serum creatinine decreased gradually from 104.3 to 90.2 according to the increase of exercise time. The index value of serum urea nitrogen also showed a downward trend, from the normal range of 5.33 to 4.95, fast into the range of abnormal values. The kidney tissues of rats in blank control group, 12 hours, 24 hours and 48 hours were observed under light microscope.

After 48 hours of exercise, the renal capsule was not thickened, the structure of skin and medulla was normal, the glomerulus had no swelling, atrophy and fibrosis, the renal tubules had no atrophy or expansion, the epithelial cells of renal tubules had no degeneration and necrosis, no abnormal tubular type was found in the lumen, the descending branches and collecting tubules of renal medulla were normal, and no inflammatory cell infiltration was found in renal interstitium. After 24 hours of exercise, the structure of renal cortex and medulla was clear, glomerular morphology was normal, no proliferation, atrophy and fibrosis were found, renal tubular epithelial cells occasionally had slight edema, the lumen was slightly narrowed, the structure of descending branch of medullary loop and collecting tubule of renal medulla was normal, and no inflammatory cell infiltration was found in renal interstitium. After 12 hours of exercise, the structure of renal cortex and medulla was clear, the morphology of glomerulus and renal tubules was normal, without hyperplasia, atrophy, fibrosis and edema. The descending branch of medullary loop and collecting tubule of renal medulla were normal, and no inflammatory cell infiltration was found in renal interstitium. Blank control group: the structure of renal cortex and medulla was clear, the morphology of glomerulus and renal tubules was normal, no proliferation, atrophy, fibrosis and edema were found, the structure of descending branch of medullary loop and collecting tubule of renal medulla was normal, and no inflammatory cell infiltration was found in renal interstitium.

4.2. Body Weight Changes of Rats in Each Group

The body weight before exercise was the body weight of each group of rats which was immediately weighed after purchasing from animal center of our province; the body weight after adaptation period was the weight of each group of rats after adaptive feeding in the laboratory for one week; the weight increment in adaptation period was the weight gain value of rats in each group after adaptive feeding for one week; the statistical results of three groups of data showed that there was no significant difference in the weight of rats in each group. During the whole experiment, the weight of rats in each experimental group decreased, but the difference of weight loss before and after the experiment was statistically significant, as shown in Figure 2.

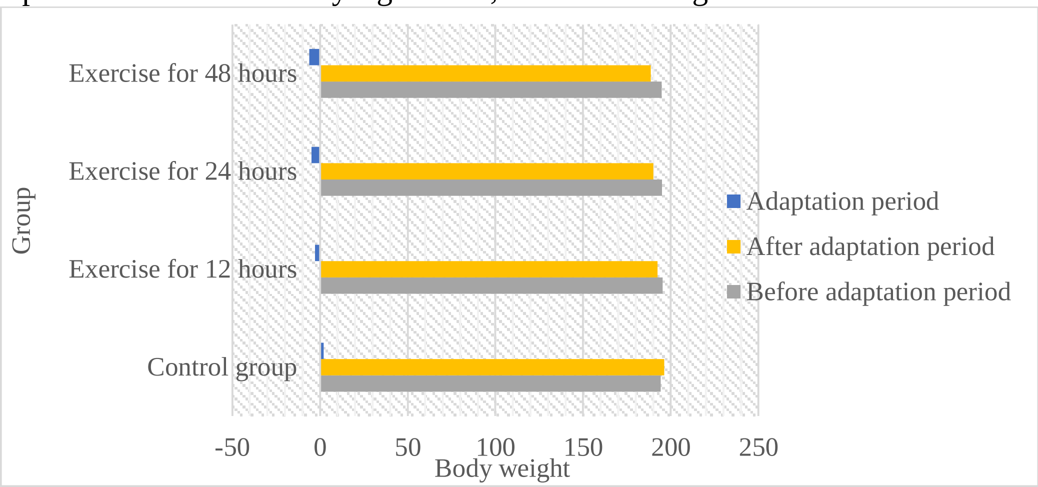

Figure 2. Weight change of rats

It can be seen from the data in the figure that the body weight of rats in the blank control group increased by 2G after the adaptation period. However, the weight of the rats who had been trained for 48 hours was reduced to 188.7g from 194.8g at the beginning, with a reduction of 6.1g. The weight of rats decreased by 2.8g after exercise for 24 hours.

4.3. Comparison of Quantitative Urine Protein

The urinary protein of rats with muscle injury induced by induced skeletal exercise was measured at 6 hours, 12 hours and 24 hours after exercise respectively. At present, the most commonly used method to evaluate urinary protein quantification is 24-hour urine protein quantification. This method is cumbersome, and affected by the accuracy of the collected samples and the bias of the samples sent for examination, which leads to the great difference between different batches of 24-hour urine protein quantitation of the same patient, which brings some troubles to the clinic. The lower the urine protein concentration is, the worse the detection accuracy is. Urinary albumin creatinine ratio (UACR) has been widely used in clinical practice in recent years. Due to its convenient detection, small variability, and its detection of albumin closely related to glomerular diseases, it has been used as the first choice for clinical evaluation of glomerular proteinuria.

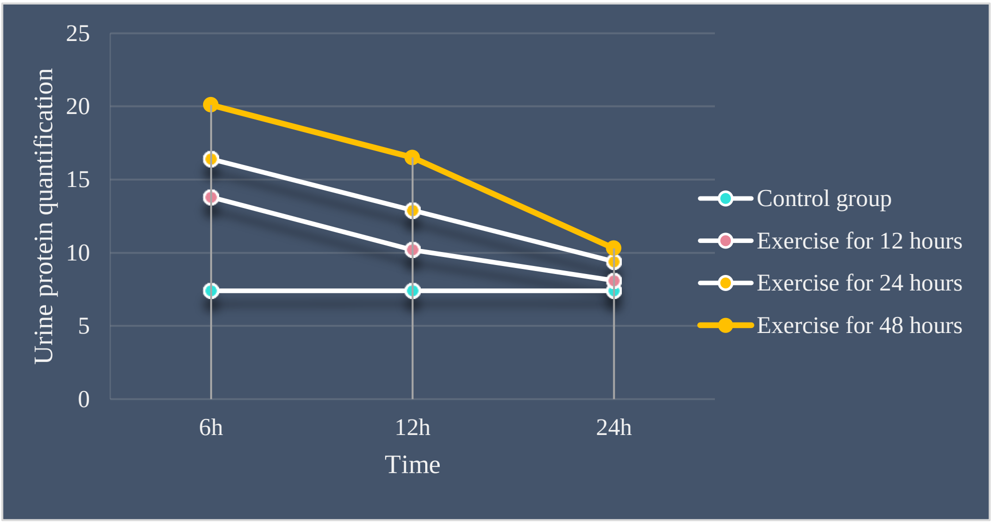

Figure 3. Quantitative comparison of urine protein

As shown in Figure 3, after 12 hours of exercise, 24 hours of exercise and 48 hours of exercise, the urinary protein content of rats increased sharply, while the level of urine protein in the blank control group was very stable, almost unchanged. Moreover, from the data trend in the figure, it is obvious that the longer the exercise time is, the higher the urine protein content will be, and with the passage of time, the urine protein content will drop to the normal range.

4.4. Comparison of Red Blood Cell Values before and after Exercise

It has been recognized by experts at home and abroad to determine glomerular hematuria by the phase method of urine red blood cells. Some studies have shown that the sensitivity, specificity, positive predictive value, negative predictive value and coincidence rate of red blood cell phase method in the differential diagnosis of glomerulonephritis hematuria were 95.2%, 95.6%, 97.6%, 89.4% and 95.3%, respectively. In this study, deformable red blood cells were found in the blood and urine of rats, including spherical, mouth shaped, flower ring shaped, gourd shaped, lotus leaf shaped, germinated yeast shaped, insect eroded, doughnut shaped, etc.

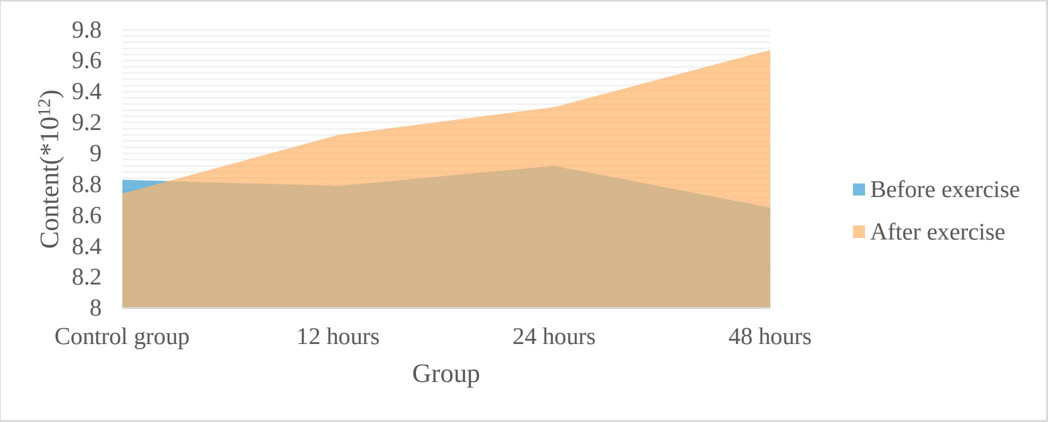

Figure 4. Changes of red blood cells before and after exercise

As shown in Figure 4, the red blood cells in the control group had almost no obvious changes, and were always in the normal range. However, the number of red blood cells in other induced skeletal muscle injury rats increased significantly. In particular, the number of red blood cells increased to 9.67 * 1012 in 48 hours exercise rats. The number of red blood cells increased to 9.3 * 1012 and 9.12 * 1012 respectively after 24 hours of exercise and 12 hours of exercise.

5. Conclusion

Using urine red blood cell phase method, combined detection of blood and urine MCV difference and renal function four indicators, can not only eliminate the error of subjective judgment, but also can improve the clinical diagnostic value of glomerulonephritis, and reduce the rate of missed diagnosis. These methods are easy to operate, high precision, small trauma and easy to accept. Through the preliminary evaluation of kidney quality at each time point after exercise, the mechanism of organ mass damage in rats was further elucidated. The number of red blood cells in kidney increased significantly and the molecular biological indexes changed, which seriously affected the kidney quality of brain dead donors. More than 4 hours after brain death, renal function damage is more and more serious with the prolongation of brain death time. Serum uric acid can be used as a predictor of early renal damage in patients with type 2 diabetes. When renal function decreases, uric acid secretion per unit glomerulus increases, while renal tubular excretion capacity remains unchanged, and renal tubular reabsorption capacity decreases. In general, it leads to an increase in serum uric acid. However, most clinical trials have shown that serum uric acid increases only when diabetic renal failure or renal failure occurs. In addition, the level of serum uric acid in patients with type 2 diabetes is also related to blood glucose, insulin and urine glucose. The increase of blood glucose leads to the increase of renal tubular glucose uptake, competitive inhibition of uric acid reabsorption, and the increase of uric acid production leads to the decrease of serum uric acid. Therefore, UA can not reflect renal function in patients with hyperglycemia.

Serum creatinine and urea nitrogen can reflect the changes of renal function in patients with diabetes mellitus. If the serum creatinine of diabetic patients is increased and azotemia occurs, it means that the patient has entered the stage of renal failure. However, a large number of clinical trials have shown that when the serum creatinine of diabetic patients increases, the body's glomerular filtration rate has decreased by at least 30%. This is due to the strong storage capacity of kidney, which delays the direct detection of serum creatinine. In addition, serum creatinine and urea nitrogen are easily affected by individual muscle mass, protein intake and body metabolism. Besides hemolysis and blood lipid, it is not easy to estimate early renal damage. But in the middle and late stage of diabetic renal failure, these two indexes can still accurately reflect renal function.

Measures taken to control the further development of the disease include intervention in eating habits and adherence to medication. Diet education is to use different low-quality dietary protein according to different symptoms of patients. As patients with kidney disease gradually enter the end stage, the complications gradually increase, and the types of drugs required are also increasingly different. It is easy to reduce the medication compliance and the occurrence of wrong and missed medication. It is necessary to effectively manage the medication situation of patients and improve the standardization and compliance of drugs. Due to the long treatment time and rich experience of foreign kidney disease, the intervention content is more detailed and complete. It is not only necessary to carry out disease training for patients, but also pay attention to the complications and psychological aspects of patients. When patients with kidney disease gradually enter the end stage, they are prone to different psychological problems, mainly including depression, anxiety, cognitive dysfunction and the decline of health-related quality of life, which leads to adverse clinical results of patients with kidney disease, which ultimately affects work, study and life, and brings huge economic losses and family burden to families and patients. However, due to the lag of management time and the lack of human and material resources, the psychological intervention of patients can only solve the problems related to the patients' current diseases, and the social and psychological needs of patients are far from being met. Therefore, effective management in this respect must be strengthened in the future.

Funding

This article is not supported by any foundation.

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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