Study on Anti-Oxidative and Anti-Exercise-Fatigue Function of Extracted Maca

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Abstract: This paper discusses the effects of the Maca in alcohol extracted Chinese herbal compound on improving sexual function of mice and anti-fatigue of the exercise mice. Sixty ICR male mice were randomly divided into 6 groups. The mice in the blank control group were fed with distilled water. The mice in the traditional Chinese medicine compound alcohol extraction group were given stomach doses respectively in accordance with 1.0, 2.1, 4.2 g dry powder / kg and 2.83 g traditional Chinese medicine / kg. The mice in maca alcohol extract group were given stomach doses in accordance with 2.1 g Maca dry powder / kg. Viagra can be a positive reference drug. The content of nitric oxide (NO) and testosterone in the serum of mice were determined by continuous administration once daily for 15 days. Another sixty ICR male mice were divided into groups according to the above-mentioned dosage (the positive drug was set as American ginseng tablets) to measure the weight-bearing swimming time, blood urea nitrogen content, lactate dehydrogenase activity and succinate dehydrogenase activity in muscle of mice after exhaustive swimming. Compared with the blank control group, the alcohol extract of Maca Compound could significantly increase the serum NO level (P <0.01), but had no significant effect on the testosterone content. Also, it can significantly prolonged the weight-bearing swimming time (P <0.01), reduce the BUN content (P <0.01) and the LDH activity (P<0.01), improve the activity of SDH in muscle (P =0.01). The alcohol extract of Maca Chinese herbal compound can significantly improve the sexual function of mice and has obvious anti-fatigue effect.

1. Introduction

Maca is native to the South American Andes which the altitude is 3500-4500m. Maca is rich in amino acids and mineral elements, low in fat, unsaturated fatty acids accounted for a higher proportion of fatty acids, reasonable nutrient composition structure, and it is a high-quality food with high nutritional value. Local residents consider maca as a food, at the same time, it is used for improving fertility, sexual function and curing female menopausal syndrome, etc. China has ratified that the maca can be a new resource food in 2011. Epimedium and Ginseng are Chinese traditional herbal medicines. Epimedium is commonly used for tonifying kidney medicine and it is provided with the effects of nourishing kidney and tonic yang, strengthening the bones and muscles and relieving rheumatism. Studies have shown that the main bioactive components of Epimedium is flavonoids, such compounds can achieve the effect of anti-fatigue by reducing the body's free radicals. The Ginseng's main pharmacological active ingredient is ginsenoside, with the effect of strengthening the function of the heart, calming, and activating the function of digestive system. Maca slice is a health food product based on Maca powder, epimedium extract and ginseng powder as the main raw material, and mainly used to alleviate physical fatigue.

In this paper, the Maca whether has anti-fatigue effect is evaluated by determining the weight-bearing swimming time, blood urea nitrogen content, lactate dehydrogenase activity and succinate dehydrogenase activity of the mice.

1. Materials and Instruments

1.1 Materials

The Maca is provided by Jiangsu Tuosheng Biomedicine Technology Co., Ltd. Chinese traditional medicine compound is bought in Nanjing Hospital of T.C.M. Viagra (sildenafil citrate tablets (batch number: Zhunzi H5020208)), American ginseng tablets (Fujian force Fick Pharmaceutical Co., Ltd.: batch number: Wei fresh food word (2000) No. 3046).

1.2 Experimental animals

ICR male mice, 2 months old, weight (20 ± 2) g, were purchased from Yangzhou University Experimental Animal Center.

1.3 Main reagents and instruments

Mouse testosterone (T) enzyme-linked immunosorbent assay kit, Shanghai Biyun tian Biotechnology Co., Ltd. (R & DSystems packaging). NO kit, Shanghai Biyun Biotechnology Co., Ltd. Serum urea nitrogen (BUN) kit, lactate dehydrogenase (LDH) kit, succinate dehydrogenase (SDH) kit were purchased from the Nanjing Institute of Biotechnology. 752 UV-visible spectrophotometer, Shanghai Precision Science Instrument Co., Ltd. Sorvall RC-6 Ultra-Speed Refrigerated Centrifuge, Kendro Laboratory Products.

1.4 Real maca and traditional Chinese medicine compound extraction

(1) Preparation of alcohol abstract of maca: Weighed 2.1g maca dry powder, 95% ethanol 80 °C reflux extraction 2 times, each 1h. The two extracts were combined and concentrated under reduced pressure to prepare extract for standby application.

(2) Preparation of the alcohol extract of Maca Chinese medicine compound: Weigh the Maca dry powder 1.0, 2.1 and 4.2g (the maximum dose of human body 25g / d as the highest dose, the highest dose of 1/2 and 1/4 respectively As the medium and low dose), 95% ethanol 80 °C reflux extraction 2 times, each 1h. The two extracts were combined and concentrated under reduced pressure to prepare three doses of macso extract for standby application.

(3) Content determination of the main composition Alkaloids and Ginsenosides in the the alcohol extract of Maca Chinese medicine compound: 1) Method for determination of alkaloids content in maca: With reference to Pharmacopoeia 2010 version of a precision that take acetonide standard 5.0mg, and add chloroform into each 1ml, containing 0.1mg solution to prepare of the alkaloid standard solution. After measuring precisely the reference solution 0.5, 1.0, 2.0, 3.0, 4.0, 5.0mL, place them separately in 25mL volumetric flask, and add precisely 0.2mol / L potassium hydrogen phthalate buffer buffer (take 0.2mol / L phthalic acid Hydrogen potassium solution 100mL, adjust the pH value of 5.0 with 0.2mol / L sodium hydroxide solution of about 50mL, that is) 5mL, and then add precision 0.03% bromine thymol blue test solution (take bromothymol blue 0.05g, with 1mol / L 0.5mol sodium hydroxide solution to dissolve, diluted with water to 100mL, that is) 2mL, add chloroform to the mark, shake vigorously, and transfere to the separatory funnel, place 45min. Take chloroform solution, and filter with dry filter paper, get rid of the filtrate, the corresponding reagent as blank, the UV-visible spectrophotometry at 412nm wavelength measured absorbance. The absorbance as the vertical axis, the concentration as the abscissa, draw the standard curve. The alcohol extract of Maca Compound was dissolved in chloroform, and the alkaloid content in the alcohol extract was determined by the above-mentioned method. 2) The content of ginsenoside in maca extract was determined by the method of Chinese Pharmacopoeia 2010 edition.
1.5 Determination of testosterone and NO content in serum

Sixty ICR male mice weighing $20 \pm 2$ g were used. The mice were randomly divided into 6 groups, 10 in each group, after being fed 2 days in laboratory. The mice in maca Chinese medicine compound group were intragastric administration respectively according to the dosage of 1.0, 2.1 and 4.2g dry powder / kg and 2.83g Chinese herbal medicines / kg. The mice in maca alcohol extract group were intragastric administration in accordance with 2.1 g Maca dry powder / kg. The blank control group was treated with distilled water. The drug was administered once a day with a dose of 0.02 mL / g, and continue 15 days. After the last administration, 20 μL blood was collected from the inner canthus of mice, and take serum to detect the testosterone and NO content.

Sixty ICR pure male mice weighing $(20 \pm 2)$ g were randomly divided into six groups: blank control group, maca alcohol extract middle dose group, low, middle and high dose of maca Chinese herbal compound alcohol extract group. Each group was administrated once a day, each dose of 0.02mL / g (drug preparation with reference to 2.2). As a positive drug, the dose of Ginseng is 1.2g / kg. The blank control group was treated with distilled water, and continue 15 days. After the last administration, the mice were fasted for 2 hours. Each mice’s tail was loaded with lead sheath which is 5% self-quality, then placed in the swimming pool to swim. The depth of the swimming pool is 40cm, and the water temperature is $(25 \pm 1)$ ℃. Then recorded the time from beginning to exhaustion. Standard to determine the mice exhausted [6]: When the mouse’s head was all into the water for 8s and could not swim out of the water, the determine was end.

1.6 Determination of blood urea nitrogen (BUN), lactate dehydrogenase (LDH), muscle succinate dehydrogenase (SDH) activity

After weight-bearing swimming till exhausted and resting for 2 days, let the mice swim for 30min without weight-bearing. Swimming conditions see "2.3". After swimming, dried the mice’s body immediately, and put the mice to death immediately after taking blood in the inner canthus. Then took the muscle out, washed with physiological saline, treated according to the tissue treatment conditions, and measured the activity of SDH enzyme in muscle tissue, the BUN content in serum and LDH enzyme activity.

1.7 Statistical Analysis

Establish a database with excel, use Graphpad package variables for each group of variance analysis and t test, and all data are expressed with.

2. Results

2.1 Determination results of testosterone and NO content in the serum

As shown in Fig. 1, the testosterone content in the serum of the mice fed with low, medium and high dose of the maca Chinese herbal compound alcohol extract had a certain increase, but there was no significant difference in groups. Compared with the blank control group, the content of NO in serum of the mice increased, and the NO level in the compound group of the middle and high dose of Maca had significant difference compared with the blank group. The results showed that the ethanol extract of compound of Maka and herbal compound had obvious effect on improving the sexual function of mice.

![Figure 1: Testosterone and NO concentration of mice treated bylow, middle, high dose of maca compound extract, middledose of maca and Vigra](image)

Figure 1: Testosterone and NO concentration of mice treated by low, middle, high dose of maca compound extract, middle dose of maca and Vigra

2.2 Determination results of weight-bearing swimming exhausted time of the mice

The improvement of exercise endurance is the most powerful macroscopic manifestation of anti-fatigue ability. The length of swimming time can reflect the extent of animal fatigue. From Figure 2, we can see that the swimming time of the middle dose group of maca alcoholic extract and the low, middle and high dose groups of the maca compound alcohol extract was obviously longer than that of the blank control group, and the difference was significant, which was statistically significant. The results showed that the alcohol extract of maca had obvious anti-fatigue function. Comparing with the unilateral group, the swimming time of the compound group was longer than that of the unilateral group, and the difference was significant, which showed that the Maca Chinese herbal compound alcohol extract had a good anti-fatigue effect.
2.3 Determination results of blood urea nitrogen (BUN), lactate dehydrogenase (LDH), muscle succinate dehydrogenase (SDH) activity

As shown in Fig. 3, the contents of BUN in the serum of mice treated with ethanol extract of maca and alcohol extract of maca compound were all decreased, and there was significant difference compared with the blank group, which was statistically significant. The LDH activity of the mice in the treatment group was all decreased, and there was significant difference between the low-dose group of the maca compound alcoholic extract and the blank group, and the middle and high-dose compound group had extremely significant difference compared with the blank group, which was statistically significant. Compared with the blank control group, the SDH activity of the treatment group showed an increasing trend, and there were extremely significant differences between the middle- and high-dose of the maca compound alcohol extract and the blank control group, which was statistically significant.
Improving the muscle's aerobic metabolism is the key to improve the body’s muscle fatigue resistance, and the aerobic metabolism ability of the muscle can be reflected by detecting the related enzyme activity of oxygen metabolism in muscle. SDH is an important metabolic enzyme in aerobic metabolism of the tricarboxylic acid cycle. So the enzyme activity often is used as the index of human skeletal muscle aerobic metabolism. The results showed that the SDH activity showed an increasing trend, indicating that Maca extract and compound extract had significant anti-fatigue effect.

4. Conclusion

At present, the development of Maca health care products stay more in the stage of the Maca raw material rough processing. In order to further study Maca, to understand and promote its development and application in China's health care products industry, through the study on the effect of Maca and Chinese herbal compound ethanol extract on improving mice’s sexual function and anti-fatigue effect of the exercise mice, this paper conclude that the extract from maca and herbal compound has a remarkable function of improving sexual function and anti-fatigue effect, and has wide application prospect in the development of health food with improved sexual function and anti-fatigue function.

Acknowledgments

References