Advance Journal of Food Science and Technology 10(2): 149-152, 2016
DOI: 10.19026/ajfst.10.1816
ISSN: 2042-4868; e-ISSN: 2042-4876

Submitted: July 2, 2015 Accepted: August 5, 2015 Published: January 15, 2016

Research Article

Pharmacodynamics Function of Athletic Fatigue Relief Health Food

Xiangyang Zhang
Department of Physical Education Teaching and Research, Liaoning University, Liaoning, 110036, China

Abstract: This study explored the relaxation effect of health food on the fatigue mice after exercise and discussed the pharmacodynamics function of it by measuring loaded-swimming time of mice as well as content of serum urea, hepatic glycogen and blood lactic acid. It was found that, the loaded-swimming time of mice in experimental group was much longer than control group and the difference was statistically significant ($p<0.05$); the serum urea value of mice was much lower than usual after swimming ($p<0.05$) while the hepatic glycogen value was much higher ($p<0.05$); blood lactic acid value was lower than control group and it was still lower after half an hour and the difference was statistically significant ($p<0.05$). Compound ginseng extract can effectively prolong loaded swimming time of mice, reduce serum urea content of mice after exercise, increase hepatic glycogen reserve of mice after medication and reduce lactic acid production of mice after exercise. Therefore, fatigue relief health food like compound ginseng extract can effectively strengthen body's adaptive capacity to exercise loads and resist fatigue.

Keywords: Compound ginseng extract, fatigue relief effect, health food, mice, pharmacodynamics

INTRODUCTION

In recent years, with the development of economy and the improvement of living level of people, the satisfaction from food and clothing are not enough for people and they begin to pay more attention to healthy bodies. However, our health and life quality are being influenced all the time by many factors like accelerating social pace, growing stresses from work, family and society, polluted environment and intake of junk food (Rongli, 2014). Some related data show that there are more than 70% people in the world suffering from sub-health, which provides health care products that can improve the problem with a huge market. Fatigue, as a very common feeling of body in daily life, is usually neglected by people because it is not considered to be disease-causing (Jingtao, 2014). Stress and sleep quality are two important factors that will influence human health and discussions about the relationship between two as well as the coping mechanism becomes the focus of attention of psychology and medicine (Huiying, 2012). As a kind of common and weak creature, human beings are inevitably constrained and restricted by nature. Human bodies can only be exploited finitely and if they were overused, they could not be recovered fully just like an over pulled spring. Fatigue can be divided into acute fatigue and chronic fatigue. Chronic fatigue syndrome was officially named by US Centers for Disease Control in 1987 (Xiaoyan *et al*., 2015) and it has a high incidence rate, 522/100,000 for female and 291/100,000 for male (Jason *et al*., 1999). Such kind of patients will feel tired and uncomfortable even without doing vigorous exercises or heavy physical work. Generally speaking, chronic fatigue is caused by various long-term diseases and has latency and chronicity. It recovers slowly and only with relaxing recuperation for a long time can reduce symptom which will definitely have bad effect on daily life and health. Presently, most fatigue researches are about athletic fatigue. When it comes to Comprehensive National Power comparison, sports quality is also very necessary. With the development of sports, more and more experts begin to do researches on athletic fatigue. Besides, sleep quality is also an issue that will happen to people of all ages. International community accepts ample sleep time, balanced diet and proper exercises as three standards of health (Chunzi and Sleep, 2014). Sleeping problems will make people become nervous, forgettable and distracted which will cause severe influence on work and study efficiency.

The report of World Health Organization says work fatigue and stress are two most dangerous killers of human health and this proves that over fatigue is an important factor that causes diseases. In recent years, researchers found out that we usually neglect hidden risks that have not been demonstrated obviously. In a society that economy is developing fast, the harm of fatigue is more horrible compared to actual diseases. North American Nursing Diagnosis Association defined fatigue as "with self-cognition, a person experiences unbearable and continuous feeling of fatigue as well as declining physical strength and brain work ability (Carpenito, 1995)." Fatigue influences our work and study. What's more, it is a dangerous invisible killer to people with poor psychological enduring capacity.

Teenagers and office workers are under the stress of graduation examination and making a living respectively. They have so many things to deal with every day which will easily make them feel extremely tired and also will threaten their health. Health food contains fatigue resisting substances which can effectively relieve human fatigue and discomfort. This study took health food extracts like ginseng, pueraria, cartialgenous, etc., as objects and used mice to do experiments to study the pharmacodynamics function of athletic fatigue relief health food.

MATERIALS AND METHODS

Experimental materials, reagent and instruments: Compound ginseng extract was taken as test sample and 250 Institute of Cancer Research (ICR) male mice weighted from 19~22 g were taken for tests. Using distilled water, compound ginseng extract was made into three concentrations which were 5, 10 and 15 mg/mL, respectively. They were corresponded with three dose groups respectively which were 100, 200 and 300 mg/kg, respectively and were kept in 5°C for mice fatigue resisting experiment. Serum urea kit, hepatic glycogen kit and blood lactic acid kit were all bought from Nanjin Jian Cheng Biological Production Co. Limited. Main instruments were UV-9200 ultraviolet and visible spectrophotometer bought from Beijing Rayleigh Analytical Instrument Corp. Ltd. and AL204 electronic scales bought from Mettler Toledo instrument (Shanghai) Co., Ltd.

Methods: The loaded-swimming experiment of mice was performed first. Fifty ICR male mice weighted from 19~22 g were divided into normal saline control group and three compound ginseng extract dose groups (100, 200 and 300 mg/kg, respectively). Mice were administrated with drug (0.2 mL/10 g) by enteroclysis every day and were weighed every Sunday. Then they were drenched according to their weight. After four weeks, loaded-swimming time of mice was tested. Thirty minutes later after they were given experimental samples in the last, mice with 5% weight on the tails were put into a swimming box. All the fours of mouse were moving in the whole process of experiment and the time from swimming at the beginning to the death of mouse was considered as the load-swimming time of mouse.

Data measuring: After the loaded-swimming experiment of mice, their serum urea, hepatic glycogen and blood lactic acid were measured. Group division and drenching method were the same as above. The method of orbit venous blood was used 30 min later after they were given experimental samples in the last. Then their blood lactic acid was measured according to the specification in kit and after that they were put into the swimming box with 30~40°C water to swim for half an hour without extra weight. After 25 min for rest, their eyeballs were taken out for blood collecting and hepatic glycogen and blood lactic acid were measured according to the specification in kit. Then they were put to death and their livers were taken out, rinsed by normal saline and blotted up by filter paper. Totally 100 mg liver was weighted accurately and then ground and centrifuged using homogenizer. After that, pre-cooled normal saline was added into it and 10% of tissue homogenate was made. The above solution was refrigerated centrifugation in low temperature and the hepatic glycogen value was measured. The calculation formula of blood lactic acid's area under the curve is: Blood lactic acid's area under the curve = 5* (blood lactic acid value before swimming+3* blood lactic acid value 0 min after swimming+2* blood lactic acid value 25 min after swimming).

Statistical method: Time of swimming, serum urea, hepatic glycogen and blood lactic acid were all presented by mean±standard deviation and statistically analyzed by SPSS 13.0. Mean comparison was made by one-way analysis of variance to observe the statistical significance in differences between groups.

Table 1: Influence from compound ginseng extract to loaded-swimming time of ICR male mice (mean±standard deviation, n = 10)

Groups	Drenching dose/ (mg/kg)	Weight of mice at beginning/g	Weight of mice at last/g	Growth of weight/g	Loaded-swimming time/min
Blank control group	-	19.3±0.6	39.0±4.0	21.2±3.6	9.56±3.60
Low dose group of compound ginseng extract	100	19.1±0.6	38.2±4.0	19.6±4.0	9.05±3.75
Middle dose group of compound ginseng extract	200	19.2±0.7	38.1±4.0	19.3±3.5	12.16±4.86
High dose group of compound ginseng extract	300	19.0±0.6	38.1±3.9	19.6±3.8	13.56±4.13#
Positive group	20	19.3±0.6	37.8±3.7	19.0±3.4	14.65±6.01#

Compared to blank control group; #: $p<0.05$

Table 2: Influence from compound ginseng extract of ICR male mice's serum urea and hepatic glycogen (mean±standard deviation, n = 10)

Groups	Drenching dose/ (mg/kg)	Weight of mice at beginning/g	Weight of mice at last/g	Growth of weight/g	Serum urea/ (mmol/L)	Hepatic glycogen/ (mg/g)
Blank control group	-	19.2±0.6	39.2±2.8	21.4±2.6	14.45±4.42	23.35±7.75
Low dose group of compound ginseng extract	100	19.2±0.6	38.2±3.8	20.6±3.5	14.35±3.72	25.25±8.50
Middle dose group of compound ginseng extract	200	19.2±0.6	38.0±3.5	20.4±3.2	12.74±3.95	28.05±0.05
High dose group of compound ginseng extract	300	19.2±0.6	38.0±2.5	20.4±2.2	10.41±3.45#	29.75±6.95#
Positive group	20	19.1±0.6	38.2±3.9	20.7±3.6	9.97±4.01#	30.51±7.93#

Compared to blank control group; #: $p<0.05$

Table 3: Influence from compound ginseng extract of ICR male mice's blood lactic acid (mean±standard deviation, n = 10)

Groups	Drenching dose/ (mg/kg)	Blood lactic acid value			
		Before swimming	0 min after swimming	25 min after swimming	Area under the curve
Blank control group	-	3.32±1.52	12.15±6.04	6.11±3.05	256.56±125.45
Low dose group of compound ginseng extract	100	3.34±1.45	10.42±4.69	5.36±2.31	225.14±99.52
Middle dose group of compound ginseng extract	200	3.28±1.89	10.86±6.25	5.64±3.21	236.12±132.02
High dose group of compound ginseng extract	300	3.01±1.60	7.81±5.20#	4.03±2.53	172.05±107.25#
Positive group	20	2.64±1.52	7.21±4.65#	3.62±2.45#	152.20±99.86#

Compared to blank control group; #: $p<0.05$

RESULTS AND DISCUSSION

Results:

Influence from compound ginseng extract to loaded-swimming time of ICR male mice: Enhance of exercise tolerance is a macroscopic manifestation of fatigue relief while longer loaded-swimming time means better fatigue resisting effect (Weiping *et al*., 2012). After four consecutive weeks of compound ginseng extract intake, there were no signs of toxicity and bad effect in mice and on the contrary and they all showed good growth. There is no statistically significant difference of mice's growth compared to normal saline control group (Table 1).

Influence from compound ginseng extract to ICR male mics serm urea, hepatic glycogen and blood lactic acid after swimming: After four consecutive weeks of compound ginseng extract intake and according to above methods, the measured results of serum urea, hepatic glycogen and blood lactic acid are shown in Table 2 and 3.

Discussion: When people are doing sports or laboring, human bodies are in a high intensity stringent state and bodies or other body parts will react actively to keep or balance movements. A lot of researches in China and overseas found that oxidative stress response is related to chronic fatigue. However, whether oxidative stress response is the cause or outcome of fatigue have been unknown yet (Lecarpentier, 2007; Logan and Wong, 2001). Besides, the relationship between antioxidant activity and fatigue relief is also a hotspot that scholars study. Porsolt *et al*. (1977) used swimming experiment verified that food with antioxidant substances can relieve fatigue and Singh *et al*. (2002) found that fatigue can be relieved from reducing lipid oxidation. The physiological changes of human body produced in sports are mainly energy substances consumption, loss of moisture, loss of electrolyte, accumulation of lactic acid, free radical damage, internal environment disturbance, etc. The fatigue relief function of health food is based on following theories: it can delay the exhausting speed of muscle glycogen, eliminate energy metabolism caused lactic acid and maintain the normal metabolism of body during the movement. The experiment showed that fatigue relief health food could significantly extend loaded-swimming time of mice and its effect was better than sports drinks sold on market. Fatigue relief health food could well influence fatigue related biochemical index, showing its fatigue resisting effect. The study showed that low, middle and high dose groups of fatigue relief health food all significantly extended the loaded-swimming time of mice and it grew along with the increase of dose in each dose group and showed a certain dosage effect which indicated that fatigue relieving health food can enhance the exercise tolerance of mice.

At present, it is believed that the causes of athletic fatigue are related to the excessive consumption of energy source, accumulation of fatigue substances in body, disturbance of internal environment, decompensation of nervous system, enzyme and hormone during the exercise, etc., (Defeng *et al*., 2012; Orlandi *et al*., 2012). The enhancement of exercise tolerance is the most direct presentation of reinforcement of fatigue resisting ability and the length of loaded-swimming time shows the degree of fatigue. Fatigue is a complicated process of physiological change and its causes are various, including accumulation of metabolic substance, consumption of energy source, etc. Lactic acid is the production of anaerobic glycolysis. The accumulation of lactic acid from long time intense exercises will influence the relative stability and normal metabolism of body environment. The urea in blood is the production from catabolism of protein and amino acid in body. The accelerating of metabolism of protein and amino acid will increase the content of urea. According to the test methods of fatigue relief function in Technical Specifications of Health Food Inspection and Evaluation (2003 version) (Chinese Ministry of Health, 2003), mice were experimented with loaded-swimming test after four weeks and their serum urea, hepatic glycogen and blood lactic acid were measured to observe weather there was fatigue relief function (Deqi *et al*., 2011). In the experiment, the loaded-swimming time of mice in 300 mg/kg compound ginseng extract group was much longer than control group ($p<0.05$). Serum urea value was significantly reduced after swimming ($p<0.05$) and hepatic glycogen value was significantly increased ($p<0.05$). Blood lactic acid value was lower than control group and after resting for 25 min, it was still lower than control group and the

difference had statistically significant ($p<0.05$). Therefore, compound ginseng extract is proved to be able to significantly enhance exercise tolerance and resist fatigue. Fatigue relief health food can significantly extend the loaded-swimming time of mice, increase the content of hepatic glycogen in mice's bodies and reduce the consumption of glycogen after vigorous exercises. Besides, it can obviously inhibit accumulation of blood lactic for mice in rest state, but has no influence on serum urea. To sum up, compound ginseng extract is able to relieve fatigue.

CONCLUSION

Fatigue relief health food like compound ginseng extract can increase energy substances and glycogen reserve as well as accelerate the elimination of harmful metabolites, which are good for fatigue relief. Based on former studies, this study comprehensively discusses the effects of compound ginseng extract on fatigue relief, which does not only lay a theoretical foundation for fatigue relief health food development and its functional mechanism, but also provides reliable thoughts for how to relieve fatigue to improve modern sports level.

REFERENCES

Carpenito, L., 1995. Nursing Diagnosis: Application to Clinical Practice. Philadelphia, Lippincott, pp: 58.

Chinese Ministry of Health, 2003. Technical Specifications of Health Food Inspection and Evaluation. Science and Technology of China Press, Beijing.

Chunzi, G. and J. Sleep, 2014. China Stat., 12: 50-51.

Defeng, Z., Q. Fenglei, W. Ru and C. Wenhe, 2012. Study of invigorating spleen and qi recipe on anti-exercise-induced fatigue. Liaoning J. Tradit. Chinese Med., 39(1): 60-62.

Deqi, S., W. Wenlei, F. Wenhui and M. Bing, 2011. Anti-fatigue ability effect study of donkey milk powder on mice. J. Xinjiang Med. Univ., 33(1): 11-15.

Huiying, R., 2012. A Relationship study on Work Stress, Dispositional Optimism, Locus of Control and Sleep Quality of College Teachers. M.Sc. Thesis, Harbin Engineering University, Harbin.

Jason, L.A., J.A. Richman, A.W. Rademaker, K.M. Jordan, A.V. Plioplys, R.R. Taylor, W. McCready, C.F. Huang and S. Plioplys, 1999. A community-based study of chronic fatigue syndrome. Arch. Int. Med., 159(18): 2129-2137.

Jingtao, J., 2014. Study on the concept of fatigue in traditional Chinese medicine. China Med. Herald, 11(28): 81-84.

Lecarpentier, Y., 2007. Physiological role of free radicals in skeletal muscles. J. Appl. Physiol., 103(6): 1917-1918.

Logan, A. and C. Wong, 2001. Chronic. Fatigue syndrome: Oxidative stress and dietary modifications. Altern. Med. Rev., 6(5): 450-459.

Orlandi, A.C., C. Ventura, A.L. Gallinaro, R.A. Costa and L.V. Lage, 2012. Improvement in pain, fatigue and subjective sleep quality through sleep hygiene tips in patients with fibromyalgia. Rev. Bras. Reumatol., 52(5): 666-678.

Porsolt, R., A. Bertin and M. Jalfre, 1977. Behavioral despair in mice: A primary screening test for antidepressants. Arch. Int. Pharmacod. T., 229(2): 327-336.

Rongli, L., 2014. Analysis of Procyanidine in Health Food and its Asthenopia Relief Effect. Fujian College of Traditional Chinese Medicine, Fuzhou.

Singh, A., V. Garg, S. Gupta and S.K. Kulkarni, 2002. Role of antioxidants in chronic fatigue syndrome in mice. Indian J. Exp. Biol., 40(11): 1240-1244.

Weiping, H., Z. Xiaoyun, C. Meichun *et al*., 2012. Fatigue relief effect of fresh momordica grosvenori drinks. Guangxi J. Light Ind., 3: 1-2.

Xiaoyan, W., X. Weiyu and W. Xiaoyan, 2015. Treatment experience of chronic fatigue syndrome. Shaanxi J. Tradit. Chinese Med., (2): 215-216.