

Experimental Study of Anti-fatigue on the Functional Liquid of Chinese Traditional Medicine

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Abstract: Objective: To observe the anti-fatigue effect of the functional liquid of Chinese traditional medicine, we did some experiments in mice. Methods: Anti-fatigue of mice was assayed according to test methods of anti-fatigue function in "Functional assessment procedure and test methods of health food" which is provided by MOH. Results: The functional liquid of Chinese traditional medicine could obviously prolong the time of mouse loaded-swimming ($p < 0.05$ or $p < 0.01$). And after the swimming, it could significantly increase the hepatic glycogen ($p < 0.01$), reduce the content of BUN, LDH, CK and increase the content of GLU, RBC, Hb ($p < 0.05$ or $p < 0.01$). But there was not significant difference at WBC, MCV. The functional liquid had no influence on weights of the mice from different groups. Conclusion: The functional liquid of Chinese traditional medicine has shown the effect of anti-fatigue. It could postpone the appearance of fatigue and accelerate renewing from fatigue obviously.

Key words: the functional liquid of Chinese traditional medicine; anti-fatigue; experimental test

复方中药功能液抗疲劳作用的实验研究

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摘 要: 目的: 观察复方中药功能液对小鼠的抗疲劳作用的影响。方法: 根据卫生部《保健食品的功能学评价程序和检验方法》中抗疲劳检验方法进行实验研究。结果: 复方中药功能液能明显地延长小鼠负重游泳时间 ($p < 0.05$ 或 $p < 0.01$); 明显地增加了运动后小鼠的肝糖元含量 ($p < 0.01$); 降低了小鼠血清中的尿素氮、乳酸脱氢酶、尿酸酶等指标, 增加了血糖、红细胞、血红蛋白等指标 ($p < 0.05$ 或 $p < 0.01$), 对白细胞数等指标影响不明显; 对小白鼠体重的增长也无显著影响。结论: 此人参等复方中药功能液具有明显的抗疲劳作用, 还具有推迟小鼠运动性疲劳的出现和促进疲劳恢复的积极作用。

关键词: 中药功能液; 抗疲劳; 实验研究

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A kind of functional liquid was abstracted from compound Chinese traditional medicine made of ginseng etc. In order to develop series of health foods, we must observe the effect of the functional liquid on anti-fatigue in mice. Anti-fatigue of mice was assayed according to test methods of anti-fatigue function in "Functional assessment procedure and test methods of health food" which is provided by MOH. To further understand the possible mechanisms of the

functional liquid on anti-fatigue in mice, the study discussed on the loaded-swimming time and changes of biochemistry targets in serum and of the blood targets in mice [1].

1 Materials and Instruments

1.1 Materials

The functional liquid of Chinese traditional medicine was abstracted from twenty kinds of Chinese medicinal

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material, which could be used as food and drug, including Ginseng, Rhodiola, Honghua, Danggui etc.

Animal for experiments: Mice, which must be healthy inbreeding Kunming race, were purchased from Changchun biological product laboratory. The weight of every mouse must be 202g. Male mice and female mice are equal in number [2].

1.2 Instruments

Fully automatic analysis instrument for blood cell: KZ-21, made in SYSMEX Company, Japan. Fully automatic biochemical analysis instrument: 7020, made in HITACHI Company, Japan.

2 Methods and Results

2.1 Dose and groups design

Two hundreds mice were randomly divided into four groups: control group, low dose group, middle dose group and high dose group. 0.3ml of distilled water was administrated to every mouse in the control group every day. According to the different dose groups, the functional liquid was administrated to every mouse in 0.2 ml, 0.3 ml and 0.4ml in turn every day. After having done like this, we started anti-fatigue test in mice [3~5].

2.2 Effect of the functional liquid on the loaded-swimming time in mice

Ten mice were taken out from each group to loaded-swimming test sequentially on the thirtieth day. Male mice and female mice were equal in number. Administrating with different dose of distilled water and the functional liquid thirty minutes later, the root of each mouse's tail was loaded with galvanized wire immediately, which was five percents of its body weight pulled into different swimming boxes respectively which were filled with water (temperature: $25 \pm 0.5^\circ\text{C}$, depth: 30cm), the activity of the mouse was observed. When the mouse went to the bottom and its heart stopped beating, we counted each mouse loaded-swimming time, averaged the time of each group mice and analyzed the data of the different groups with T-test [2].

During the test, compared with the control group, the mice administrated with the functional liquid of Chinese traditional medicine were more active. Table 1 shows the results of the loaded-swimming times in mice.

The results indicate that the loaded-swimming time of mice in the experimental groups (low group, middle group, high group) was all remarkably longer than that of those in the control group ($p < 0.05$ or $p < 0.01$) and there was significant difference between the high dose group and the control

Table 1 Effects of the functional liquid on the loaded-swimming time of mice ($\bar{X} \pm S$)

| Group | n | Dose (ml/d) | Female mice (min) | Male mice (min) | Average (min) | Prolong (%) |
|---------|----|-------------|-----------------------|-----------------------|-----------------------|-------------|
| Control | 10 | 0 | 23.48 ± 1.44 | 24.11 ± 3.20 | 23.73 ± 1.92 | |
| Low | 10 | 0.2 | $29.79 \pm 5.44^*$ | $33.03 \pm 1.98^{**}$ | $31.09 \pm 4.35^{**}$ | 31.10 |
| Middle | 10 | 0.3 | $26.75 \pm 3.15^*$ | $28.69 \pm 1.64^*$ | $27.73 \pm 2.48^*$ | 17.53 |
| High | 10 | 0.4 | $34.16 \pm 4.96^{**}$ | $36.97 \pm 6.32^{**}$ | $35.85 \pm 5.34^{**}$ | 51.07 |

Note: $^*p < 0.05$, $^{**}p < 0.01$ (compared with control), $\bar{x} \pm s$ indicates average SE.

group ($p < 0.01$). In the same experimental group, the swimming time in male mice was longer than that in female mice especially. We could conclude from the results that the loaded-swimming test was a positive reaction.

2.3 Effect of the functional liquid on the hepatic glycogen in mice

To determine the hepatic glycogen of the mice respectively, we took out ten mice from each group. Male mice and female mice were equal in number too. Given different dose thirty minutes later, the mice were forced to swim in 30°C water. When the swimming lasted ninety minutes, each mouse was put to death and its liver was taken out immediately. By the method of the Anthracene-ketone Colorimetric Analysis, the hepatic glycogen of the mice from the different groups was determined directly one by one. We analyzed the data of the different groups with T-test. The results were showed in Table 2.

Compared with the control group, the hepatic glycogen of every experimental group was higher after the swimming ($p <$

Table 2 Effects of the functional liquid on the hepatic glycogen of mice ($\bar{X} \pm S$)

| Group | n | Dose (ml/d) | Hepatic glycogen (mg/100g) | p | Increase rate (%) |
|---------|----|-------------|----------------------------|----------|-------------------|
| Control | 10 | 0 | 432.57 ± 51.48 | | |
| Low | 10 | 0.2 | 643.12 ± 188.22 | < 0.01 | +44.84 |
| Middle | 10 | 0.3 | 1043.18 ± 271.13 | < 0.01 | +141.43 |
| High | 10 | 0.4 | 1165.17 ± 266.88 | < 0.01 | +169.71 |

Note: $^*p < 0.01$ (compared with control), $\bar{x} \pm s$ indicates values mean SE.

0.01). There was of significant difference between the high dose group and the control group (increasing rate: 169.71%)

2.4 Effect of the functional liquid on the biochemistry targets in serum and the blood targets in mice

We took the same number of the mice and used the same way to swim. When the swimming lasted ninety minutes, the mouse was pulled out, taken blood from their eyes immediately. 20μl blood of every mouse was put into heparin sodium. Using the fully automatic analysis instrument, we accurately

determined the main targets of the blood from the different group, which including erythrocyte (RBC), hemoglobin (Hb), leucocyte (WBC) and average dimension of erythrocyte (MCV). The serum was separated out from the rest of blood. Using the fully automatic biochemical analysis instrument to examine the serum, the main biochemistry targets in serum of the mice from the different groups, including blood urea nitrogen (BUN), blood glucose (GLU), lactate dehydrogenase (LDH) and creatine kinase (CK), were determined directly one by one. We analyzed the data of the different groups with T-test. The results were showed in Table 3 and Table 4.

Table 3 Effects of the functional liquid on the main blood targets of the mice ($\bar{X} \pm S$)

| Group | n | Dose (ml/d) | RBC ($10^{12}/L$) | Hb (g/L) | WBC ($10^9/L$) | MCV (fL) |
|---------|----|----------------|------------------------|-------------------------|---------------------|--------------------|
| Control | 20 | 0 | 6.39 ± 0.38 | 87.00 ± 9.31 | 6.07 ± 2.44 | 47.36 ± 0.94 |
| Low | 20 | 0.2 | 6.64 ± 1.18 | $99.00 \pm 11.53^*$ | 6.52 ± 1.81 | 47.65 ± 0.37 |
| Middle | 20 | 0.3 | $7.08 \pm 0.77^{**}$ | $101.25 \pm 17.40^{**}$ | 6.11 ± 1.43 | $51.11 \pm 0.68^*$ |
| High | 20 | 0.4 | $7.00 \pm 1.31^{**}$ | $100.67 \pm 24.09^*$ | $7.09 \pm 3.11^*$ | 49.91 ± 0.60 |

Note: * $p < 0.05$, ** $p < 0.01$ (compared with control), $\bar{X} \pm S$ indicates values mean SE.

Compared with the control group, the experimental groups could obviously increase the RBC and Hb of the different groups after the swimming ($p < 0.05$ or $p < 0.01$). And there was not significant difference at the WBC and MCV of the mice. The functional liquid of different doses could postpone the appearance of fatigue and accelerate renewing from fatigue.

Compared with the control group, the experimental groups could obviously reduce BUN, LDH, CK and increase the GLU after the swimming ($p < 0.05$ or $p < 0.01$). And there was significant difference between the high dose group and the control group.

2.5 Effect of the functional liquid on the weight in mice

To further understand the effect of the functional liquid on the weight, the mice were weighed and observed their increasing rate every day. After all mice had been administrated with the different dose for thirty days, the increasing rate of the mice's weight was by multivariate regression

analysis. The results were showed in Fig.1 and Table 5.

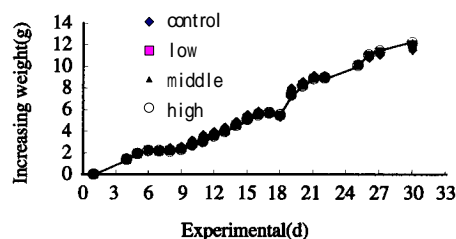


Fig. 1 Effects of the functional liquid on the weight of the different mice

Table 5 The regression equation of the functional liquid on the weight of the mice

| Group | Regression equation | R ² |
|---------|--|----------------|
| Control | $y = -6E-05x^4 + 0.0034x^3 - 0.0516x^2 + 0.6048x - 0.4318$ | 0.9835 |
| Low | $y = -7E-05x^4 + 0.0036x^3 - 0.0549x^2 + 0.5873x - 0.3629$ | 0.9901 |
| Middle | $y = -7E-05x^4 + 0.0037x^3 - 0.0566x^2 + 0.5786x - 0.3285$ | 0.9917 |
| High | $y = -7E-05x^4 + 0.0037x^3 - 0.0558x^2 + 0.583x - 0.3457$ | 0.9910 |

The increasing weights of the experimental groups were of no significant difference compared with the control group ($p > 0.05$). So the functional liquid had no obvious effect on the weight of the mice from the different dose groups within thirty days.

3 Conclusion

3.1 The results showed that the functional liquid of Chinese traditional medicine could obviously prolong the time of mouse loaded-swimming ($p < 0.05$ or $p < 0.01$). And after the swimming, it could significantly increase the hepatic glycogen ($p < 0.01$), reduce the content of BUN, LDH, CK and increase the content of GLU, RBC, Hb ($p < 0.05$ or $p < 0.01$). But there was of no significant difference at the WBC and MCV of the mice.

3.2 The mice, administrated with the functional liquid of Chinese traditional medicine for thirty days, had no obvious effect on the weight.

3.3 These results indicated that the functional liquid of Chinese traditional medicine has shown the effect of anti-fatigue. It could postpone the appearance of fatigue and

Table 4 Effects of the functional liquid on the main biochemistry targets of the mice ($\bar{X} \pm S$)

| Group | n | Dose (ml/d) | BUN (mmol/L) | GLU (mmol/L) | LDH (U/L) | CK (U/L) |
|---------|----|----------------|-----------------------|----------------------|------------------------|---------------------|
| Control | 20 | 0 | 25.22 ± 6.85 | 3.78 ± 0.62 | 173.73 ± 6.96 | 498.20 ± 8.95 |
| Low | 20 | 0.2 | $22.22 \pm 4.85^*$ | $4.30 \pm 0.44^*$ | $145.85 \pm 5.31^*$ | $445.50 \pm 6.12^*$ |
| Middle | 20 | 0.3 | $21.18 \pm 4.82^{**}$ | $4.43 \pm 0.56^*$ | $129.19 \pm 7.75^{**}$ | $455.20 \pm 9.81^*$ |
| High | 20 | 0.4 | $20.14 \pm 3.59^{**}$ | $4.69 \pm 0.37^{**}$ | $128.28 \pm 3.78^{**}$ | $444.25 \pm 7.60^*$ |

Note: * $p < 0.05$, ** $p < 0.01$ (compared with control), $\bar{X} \pm S$ indicates values mean SE.

不同剂量牛初乳粉对小鼠 免疫调节作用的研究

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摘 要: 本研究用牛初乳粉对小鼠进行喂养实验, 20d 后测定 NK 细胞杀伤活性、T 淋巴细胞增殖活性、巨噬细胞的吞噬功能, 研究了不同剂量的牛初乳粉对小鼠免疫调节作用效果。结果表明: 剂量在 36.46~1250mg/kg·d 之间的牛初乳粉都能极显著地增强巨噬细胞的吞噬功能, NK 细胞的杀伤活性和 T 淋巴细胞的增殖活性, 其中 78.13~156.25mg/kg·d 之间对小鼠细胞免疫调节作用和巨噬细胞吞噬功能增强作用效果优于其他剂量。

关键词: 牛初乳粉; 巨噬细胞; NK 细胞; T 淋巴细胞; 免疫调节

Study on Immune Modulation Effect of Different Doses Bovine Colostrums Powder on Mice

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Abstract: In this study, cytotoxic activity of natural killer cells, T-lymphocyte proliferation and macrophage function were detected after twenty days of mice feeding with different doses bovine colostrums. The results showed that the phagocytosis, cytotoxic activity of natural killer cells, T-lymphocyte proliferation could be enhanced significantly by bovine colostrums powder between 36.46mg/kg·d and 1250mg/kg·d while the doses between 78.13mg/kg·d and 156.25 mg/kg·d were superior to others.

Key words: bovine colostrums powder; macrophage; natural killer cells; T-lymphocyte; immune modulation

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牛初乳是母牛产犊最初几天内所分泌的乳汁, 与常乳相比, 牛初乳为黄褐色, 有异臭, 味苦, 粘度大,

表面张力明显小于常乳, 因此被当作一种异常乳^[1]。但近年来研究, 发现牛初乳中含有许多生理活性免疫因

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accelerate renewing from fatigue obviously.

References:

- [1] The MOH of China. Functional assessment procedure and test methods of health food[M]. Beijing, 1996, 53-57.
- [2] Sun Jingfang. Experimental Method in Animal [M]. Beijing: The Renmin health Press, 2002. 154-158, 409-512.

- [3] Chen Rendun. Nutrition and Health Food [M]. Beijing: The China Light Industry Press, 2002. 568-574.
- [4] Hu Yuming, Hu Yixiu, Zang Xuebing, et al. Experimental study of anti-fatigue on eucommia ulmoides's alcohol [J]. Practical Preventive Medicine, 2000, 5(7): 330-331.
- [5] Huang Mei, Chen Liming. Experimental study of anti-fatigue effect of 851 jinyuan tablet [J]. Strait Pharmaceutical Journal, 2000, 2 (12): 17-18.