

The Anti-obesity Effects of Sichuan Brick Tea on Rats

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Abstract: The anti-obesity effects of Sichuan brick tea on rats were investigated for the first time. The results showed that compared with the obese control group, Sichuan Brick tea could significantly reduce the obesity indicators, including the body weight of obese rat, fat coefficient, the ratio of live and body weight, the discharge amount of the crude fat in stool with dose-dependent relationship. Studies showed that Sichuan brick tea had weight loss, and the high doses of brick had optimal anti-obesity effect.

1. Introduction

Obesity is a gene hyper susceptible that causes diseases caused by neuroendocrine regulation disorders of the body fat regulation network under the influence of environmental factors [1]. With the improvement of people's life, the incidence of obesity is increasing year by year. Epidemiological investigation shows that obesity has become a major disease that endangers human health and its concomitant diseases such as hyperlipidemia, hypertension, fatty liver, cancer and type 2 diabetes mellitus are also increasing rapidly [2]. In recent years, many studies have confirmed that green tea, black tea, oolong tea and its main functional components tea polyphenols, caffeine, theaflavins, theasaponin and so on have a certain function of reducing fat and weight [3]. However, there are few reports about dark tea, especially Sichuan brick tea, in the field of slimming down.

Sichuan brick tea is produced in Sichuan province of China and has a long history. It is the earliest dark tea in China. Sichuan brick tea has its unique quality and function because of its unique raw materials and processing technology producing a variety of organic acids, tea polyphenols and their oxidation products, tea polysaccharides, vitamins and other bioactive substances. Epidemiological investigation shows that Sichuan brick tea has the effect of reducing fat and weight [4-6], but the relevant research on animal experiments has not been reported. This paper studied the slimming function of Sichuan brick tea.

2. Materials and Methods

2.1 Establishment and Grouping of Obese Rat Models

Sichuan brick tea was provided by Ya'an Friendship Tea Co., Ltd., Sichuan Province. Sixty male Sprague-Dawley rats (160±10g) were purchased from the Experimental Animal Center of Sichuan University, production license No.: SCXK (Sichuan) -10-2006 After 3days, they were randomly divided into normal control group (n = 10) and model group (n = 50) after three days of adaptation under laboratory conditions. The normal control group was fed with basic diet and the model group was fed with high-fat diet to establish obesity model. During the modeling period, the rats took food and water freely, and their weight was taken out every week. At the end of the 4th week, the rats were randomly divided into 5 groups according to their body weight as follows: the model control group, the positive drug group and the low dose of Sichuan brick tea group (drinking tea safely in human body, 0.2g/kg. BW. d), middle dose of Sichuan brick tea (1.0 g/kg. BW. d) And high dose of

Sichuan brick tea (2.0 g/kg. BW. d). the criterion for successful modeling was that the body weight of each rat in the model group was 20% higher than that in the normal control group [3].

From the 5th week onwards, 0.2, 1.0, and 2.0g/ (kg. BW. d) Of Sichuan brick tea were given to the low, middle and high dose groups respectively, and the safe body dose of L-carnitine was given to the positive drug group. The model control group and the normal control group were perfused with the same amount of distilled water for 30 days.

2.2 Observation of Indicators Related to Laboratory Animals and Collection of Tissue Samples [7]

During the experiment, the feeding amount, the leftover food amount and the scatters food amount of each group of animals were recorded, the body weight and body length were measured regularly, and the feces were collected for 72 h to test the excretion of crude fat in the feces. At the end of the experiment, the rats were fasted for 24 h, and the eyeball blood was taken from the eyeballs after the blood sample was allowed to stand, it was centrifuged at 2000 r/min for 4 min, and the serum was separated for testing. And then the rats were dissected and the fat deposition and organ changes in the rats were observed with the naked eye. Body fat (testis and perirenal fat pad) was taken and weighed to calculate the wet weight of visceral fat.

2.3 Detection Indicators

Body weight, organ index and fat coefficient, crude fat content in feces were substituted into the formula:

$$(1) \text{ Fat coefficient} = (\text{perirenal fat} + \text{testis fat}) / \text{animal body weight} \times 100\%$$

$$(2) \text{ Liver index} = \text{liver weight (g)} / \text{body weight (g)} \times 100\%$$

Blood biochemical indexes: total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL-C) and low density lipoprotein (LDL-C) of serum were measured by automatic biochemical instrument.

3. Results and discussion

3.1 General Observations of Rats

During the experiment, the feeding condition of rats in each group and activity were normal, no diarrhea and appetite suppression. There was no significant difference in food intake among groups ($P > 0.05$), and there was no significant difference in food utilization rate among groups ($P > 0.05$).

3.2 Experimental Animal Model of Obesity

Before the establishment of the model, there was no significant difference in the body weight between the normal diet group and the model group, but the body weight of the model group after the establishment of the model was significantly higher than that of the normal control group ($P < 0.01$) which indicated that the obese rat model had been established, and the results were shown in Table 1.

Table 1. Establishment of obesity model in rats ($X \pm SD$).

Group	Rat number	Initial weight(g)	Body weight after modeling(g)
Normal control	6	157.77 ± 2.88	225.50 ± 9.66
Module	30	167.83 ± 2.29	350.27 ± 4.66**

Note: compared with the control group * $p < 0.05$, ** $p < 0.01$

3.3 Effects of Sichuan Brick Tea on Body Weight of Obese Rats

As seen from Table 2, there was no significant difference among the obese rats at the beginning of gavage. After 4 weeks of treatment, the body weight of each dose group of Sichuan brick Tea was lower than that of the model group, and there was a dose-dependent relationship. The weight loss of the high dose group was the most obvious, which was significantly different from that of the

model group ($P < 0.01$). It can be seen from the table that the weight loss effect of each dose group of Sichuan brick tea is better than that of the positive drug group.

Table 2. Effects of Sichuan Bian tea on body weight of rats ($X \pm SD$)

Group	Animals only	Starting weight (g)	Final weight (g)
Normal control group	6	225.50 \pm 9.66	343.27 \pm 10.26
Obesity model group	6	348.50 \pm 13.39	455.55 \pm 10.97
Positive drug group	6	351.43 \pm 9.84	434.32 \pm 11.23
Low does group of brick tea	6	350.69 \pm 12.11	429.44 \pm 8.82
Medium dose group of brick tea	6	348.03 \pm 8.96	411.25 \pm 7.89*
High dose tea of brick tea	6	352.68 \pm 10.68	389.78 \pm 17.84** #

Note: compared with the model group* $p < 0.05$, ** $p < 0.01$, and with the positive drug group, # $p < 0.05$, the same as below.

3.4 Effects of Sichuan brick tea on body fat, fat coefficient, liver weight and liver / body weight ratio in rats

It can be seen from Table 3 that compared with the normal control group, the body fat weight and fat coefficient of the obese model group were significantly increased ($P < 0.01$), and after 4 weeks of gavage, the body fat and fat coefficient of the three dosage groups of Sichuan brick tea were obviously decreased; Compared with the obese model group, there were significant or extremely significant differences ($P < 0.05$, $P < 0.01$). The body fat and fat coefficient of the high dose group of Sichuan brick tea were significantly different from those of the model group. It shows that Sichuan brick tea can control the accumulation of fat in the body of rats, so as to achieve the effect of inhibiting the growth of fat. The effect of Sichuan Bian tea 10 times dosage group was the best.

The weight of liver in the model group was significantly higher than that in the normal control group ($P < 0.05$). There was no significant difference in the weight of liver between the three tea decoction groups and the control group. There were no significant difference, significant difference ($P < 0.05$) and extremely significant difference ($P < 0.01$) in the weight of liver between the three tea decoction groups and the model group, and the ratio of liver to body weight also showed similar results. At the same time, the liver weight and the ratio of liver to body weight in the positive drug group were also significantly different from those in the model group.

Table 3. Effects of Sichuan Bian tea on body fat, fat coefficient, liver weight and liver / body ratio ($X \pm SD$) in rats

Group	Total fat (g)	Fat coefficient (%)	Liver quality (g)	Liver / body ratio (%)
Normal control group	11.20 \pm 1.32	3.23 \pm 0.32	10.60 \pm 0.31	3.10 \pm 0.12
Obesity model group	26.40 \pm 2.03 ^{###}	5.78 \pm 0.38 ^{##}	13.00 \pm 0.64 [#]	2.84 \pm 0.08
Positive drug group	23.21 \pm 2.02	5.31 \pm 0.37	10.89 \pm 0.75*	2.50 \pm 0.14*
Low does group of brick tea	21.21 \pm 2.52	4.93 \pm 0.54*	11.53 \pm 0.34	2.68 \pm 0.07
Medium dose group of brick tea	20.91 \pm 1.01*	4.94 \pm 0.23*	10.58 \pm 0.50*	2.55 \pm 0.09*
High dose group of brick tea	14.77 \pm 1.77**	3.78 \pm 0.37**	9.69 \pm 0.59**	2.48 \pm 0.07**

3.5 Comparison of Crude Fat Content in Feces of Rats in Different Groups

After 30 days of gavage, the crude fat content in the feces of the obese model group, the positive drug group, the low, middle and high dose groups of Sichuan brick tea respectively were (10.69 \pm

0.58), (11.68 ± 0.41), (10.12 ± 0.55), (12.97 ± 0.45), (12.40 ± 0.52) g / 100g, which were higher than that of the basic diet control group. (9.41 ± 0.23) g / 100g. Among them, the crude fat content in the feces of rats in the middle dose and high dose tea group was significantly higher than that in the feces of the model group. It shows that Sichuan brick tea can excrete excess body fat and has the effect of reducing fat and losing weight.

3.6 Effect of Sichuan Brick Tea on Blood Lipid Indexes in Rats

As can be seen from Table 4, at the end of the experiment, compared to the obese model group, there was no significant difference in TC, TG, HDL-C and LDL-C among the three groups of rats with different dosages of tea decoction. While it also showed a kind of regularity. The TC, TG and LDL-C of three groups of rats with different dosages of tea decoction by gavage tended to decrease and the HDL-C tended to increase. Similar results were observed in the obese model group compared with the normal group.

Table 4. Effect of Sichuan brick Tea on blood lipid indexes in rats

Group	TC	TG	HDL-C	LDL-C
Normal control group	1.45 ± 0.10	0.81 ± 0.04	0.23 ± 0.04	0.52 ± 0.04
Obesity model group	1.58 ± 0.26	0.92 ± 0.12	0.22 ± 0.04	0.55 ± 0.05
Positive drug group	1.48 ± 0.05	0.68 ± 0.07	0.25 ± 0.01	0.54 ± 0.03
Low dose group of brick tea	1.42 ± 0.08	0.90 ± 0.06	0.29 ± 0.04	0.52 ± 0.05
Medium dose group of brick tea	1.51 ± 0.13	0.79 ± 0.07	0.21 ± 0.01	0.53 ± 0.07
High dose tea of brick tea	1.46 ± 0.08	0.73 ± 0.07	0.26 ± 0.04	0.51 ± 0.03

4. Conclusion

In recent years, many studies have confirmed that green tea, black tea, oolong tea have a certain function of reducing fat and weight [8-10]. The results in this paper showed that the Sichuan brick tea had a good function of reducing weight and fat, and its weight loss effect was better than the commercial weight loss drug L-carnitine, which may be due to the rich biological active components such as intheaflavins, thearubigins, theabrownine, monosaccharide, a large number of simple catechins and so on [11]. However, because of the complexity of the contents, the mechanism of the slimming effect of Sichuan brick tea remains to be further studied.

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References

- [1] G. L. Liu. Obesity [J]. Chinese Journal of Practical Internal Medicine, 2003 (09): 513 - 524.
- [2] Y.Q. Chen, W. Zhang, Q. Cheng, F.J. Dong, X.H. Liu, D.P. Gan, Y.P. Qian. The Anti-obesity Effects of Hubei Qingshang Tea on Rats [J]. Journal of Tea Science, 2008 (05): 363 - 369.
- [3] Y.X. Zan, T. Y. Wang, W.H. Dong, C.A. Zhao. Experimental Study on the Obesity Model in Rats Induced by High Fat Diet [J]. Modern Preventive Medicine, 2008 (16): 3131 - 3132.
- [4] J. Y. Gong, Mei. Jiao, X. Q. Wu, Y. Zhang. Study on the Corpulent-reducing Function of Tea [J]. Journal of Tea Science, 2007 (03): 179 - 184.
- [5] B. Jiang, W. X. Tian, G.N. Qi. Inhibitory effects of Sichuan brick tea extracts on fatty acid synthase [J]. Journal of the Graduate School of the Chinese Academy of Sciences, 2007, 24 (3): 291 - 299.

- [6] T. Xu. Studies on the Hypoglycemic Activity and Optimum Extraction of Theabrownine from Sichuan Brick Tea [D]. Sichuan Agricultural University, 2010.
- [7] Technical specification for inspection and evaluation of health food [M]. The Ministry of Health of the People's Republic of China, 2003: 38.
- [8] J. H. Lin, C. Lv, T.X. Hu. Veterinary pharmacology experimental course [M]. Department of pharmacy, School of veterinary medicine, Sichuan Agricultural University.
- [9] Z. G. Zhao, F.L. Lu, J. L. Liu, Y.Y. Chen, Y.X. Wen, D.P. Li, M. Liang, B. X. Sun. Effect of three natural ingredients on body weight-reducing and serum lipid-reducing [J]. *Guhaia*, 2010, 30 (01): 127 - 132.
- [10] X. H. Zhang, C. Zhao, F. Xu, L. Bing A Preliminary Experiment on the Weight-losing Effect of Pu'er Tea on Trophic Pimelosis Rat [J]. *Yunnan Journal of Traditional Chinese Medicine and Materia Medica*, 2008 (04): 38 - 39+76.
- [11] D.X. Ming. Field experiment and statistical analysis [M]. Science Press, 114 - 116.