# Effects of Chili Pepper on Inflammatory Response Factors in Rats

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**Abstract** [**Objectives**] To investigate the effects of different doses of chili pepper on inflammatory response factors in rats. [**Methods**] Sixty male SD rats were randomly divided into blank control group, high-dose chili pepper group, medium-dose chili pepper group, and low-dose chili pepper group. Chili pepper aqueous solution was administered by gavage for three months. One day after the last administration, serum and cerebrospinal fluid were collected to measure the concentrations of hs-CRP and IL-6 in serum, and PCT in cerebrospinal fluid. [**Results**] Compared with the blank control group, the high-dose, medium-dose, and low-dose chili pepper groups showed significant increases in hs-CRP, IL-6, and PCT levels ($P<0.05$). [**Conclusions**] Different doses of chili pepper exerted varying effects on inflammatory factors in rats.

**Key words** Rat, Chili pepper, Inflammation

## 1 Introduction

Mongolian medicinal chili pepper (*Capsicum annuum* L.), is also known as "Lazhu", derived from the dried mature fruits of *Capsicum frutescens* L. in the Solanaceae family[1]. Known as "Zidraga" in Mongolian medicine, it originated in South America and is now widely cultivated throughout China. Characterized by pungent taste, hot nature, and therapeutic effects of lightness, roughness, and dryness, it falls into the "Badagan"-removing category in Mongolian medicine. The *Mongolian Materia Medica* states: "Wendi chili pepper has extreme pungency and inherent functions to dispel cold-related Heyi and abdominal mass diseases." It demonstrates functions including warming the middle jiao, improving appetite, killing parasites, expelling water, resolving masses, and treating conditions like gastric coldness, anorexia, indigestion, abdominal masses, parasitic infections, ascites, hemorrhoids, "Qiha", and "Wuyaman" (leprosy)[2]. With in-depth research on phytochemical pharmacology of Mongolian medicine, its clinical applications have been expanded, ensuring scientific validity and reliability.

## 2 Materials and methods

**2.1 Experimental animals and drugs** Sixty 5 - 9-week-old SPF-grade male SD rats weighing (220 ± 20) g were provided by Liaoning Biotechnology Co., Ltd. [Certification No.: SCXK (Liao) 2015-0001]. Rats had free access to water and feed during the experiment. Laboratory environment was regularly cleaned and maintained dry and hygienic. Ambient temperature was maintained at 19 - 21 ℃. Chuan Tianjiao chili pepper (provided by Sichuan Medicinal Material Market). hs-CRP, IL-6, and cerebrospinal fluid PCT ELISA kits (Chengdu Boruike Biotechnology Co., Ltd.)

**2.2 Instruments** Electronic analytical balance (Mettler), low-temperature high-speed centrifuge (Thermo Fisher Scientific, USA), -80 ℃ ultra-low temperature freezer (Thermo Fisher Scientific, USA).

**2.3 Experimental methods**

**2.3.1** Grouping. After one week of acclimatization, SD rats were randomly divided into 4 groups: blank control group, high-dose chili pepper group, medium-dose chili pepper group, and low-dose chili pepper group. Each group contained 15 rats. The blank control group received 0.02 mL/g purified water by gavage, while high-dose, medium-dose, and low-dose groups received 0.27, 0.18, and 0.09 g/kg chili pepper solutions, respectively for three months.

**2.3.2** Detection. During the experiment, the mental state, body weight, activity level, fur gloss, and excreta color of SD rats in each group were observed. After three months of gavage administration, blood was collected from the abdominal aorta and centrifuged using a low-temperature high-speed centrifuge to separate serum, which was stored at -80 ℃. Serum hs-CRP and IL-6 levels, along with cerebrospinal fluid PCT levels, were measured using a microplate reader following the ELISA kit instructions.

**2.4 Statistical analysis** Data are expressed as mean ± standard deviation ($\bar{x} \pm s$) and analyzed using SPSS 22.0 software. *t*-tests and chi-square tests were applied according to research objectives and data types.

## 3 Results and analysis

**3.1 General observations** Chili pepper-treated rats exhibited slowed weight gain or weight loss, significantly elevated anal temperature, increased water intake, yellowish urine, dull fur, reduced mobility, and heightened irritability compared to the blank group.

**3.2 Blood biochemical results**

**3.2.1** Effects of different chili pepper doses on serum hs-CRP levels. Chili pepper or capsaicin increased serum high-sensitivity C-reactive protein (hs-CRP) concentrations in a dose-dependent manner. Clinically, hs-CRP serves as a biomarker for cardiovascular diseases, neonatal bacterial infections, and renal transplan-

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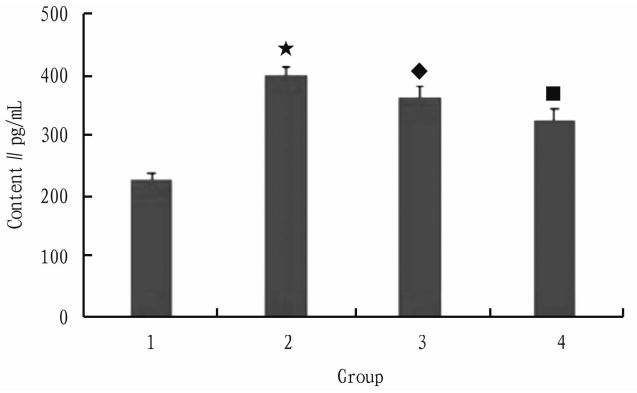
tation monitoring. As a nonspecific acute-phase systemic inflammatory marker synthesized by the liver, hs-CRP is one of the strongest predictors of cardiovascular risk[3-7]. The experiment demonstrated differential effects of chili pepper doses on serum hs-CRP levels in rats. As shown in Fig. 1, all chili pepper groups (high, medium, low doses) showed significantly elevated hs-CRP levels compared to the blank group ($P<0.05$).




**NOTE** 1. Blank group, 2. High-dose chili pepper group, 3. Medium-dose chili pepper group, 4. Low-dose chili pepper group; There was a significant difference in hs-CRP between the high-dose chili pepper group, the medium-dose chili pepper group, the low-dose chili pepper group and the blank group ($P<0.05$). The same below.

**Fig. 1 Comparison of hs-CRP levels among groups ($\bar{x}\pm s$)**

**3.2.2** Effects of different chili pepper doses on serum IL-6 levels. Interleukin-6 (IL-6), a pleiotropic cytokine, is produced by fibroblasts, mononuclear/macrophages, T/B lymphocytes, epithelial cells, keratinocytes, and various tumor cells. IL-6 regulates immune responses, acute-phase reactions, hematopoiesis, and plays crucial roles in anti-infection immunity[3,8-9]. During infections and inflammation, IL-6 levels rise rapidly first, subsequently inducing PCT and CRP elevation within hours. Fig. 2 shows that all chili pepper groups exhibited increased IL-6 levels versus the blank group, with the high-dose group showing the most pronounced elevation.

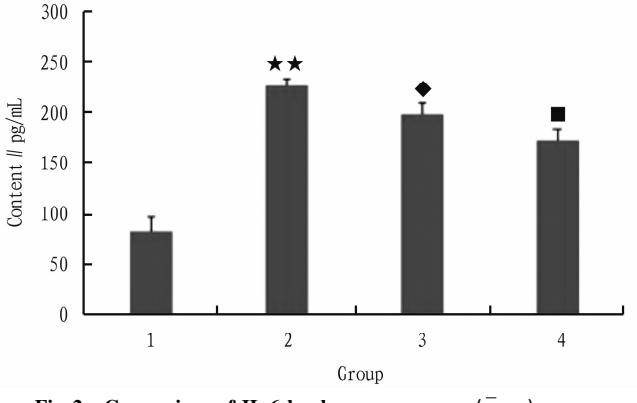



**Fig. 2 Comparison of IL-6 levels among groups ($\bar{x}\pm s$)**

**3.2.3** Effects of different chili pepper doses on cerebrospinal fluid PCT levels. Procalcitonin (PCT), a protein whose plasma levels increase during bacterial/fungal/parasitic infections, sepsis, and multi-organ failure. PCT reflects the intensity of systemic inflammatory responses. Factors influencing PCT levels include infected organ size/type, bacterial species, inflammatory severity, and immune status[10-12]. As shown in Fig. 3, all chili pepper groups had elevated PCT levels compared to the blank group, with the high-dose group showing the greatest increase.

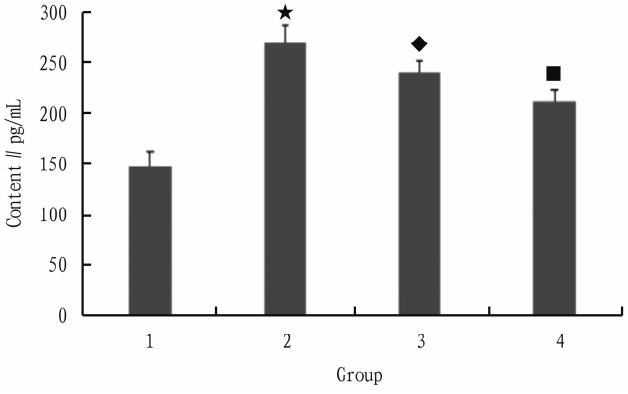



**Fig. 3 Comparison of PCT levels among groups ($\bar{x}\pm s$)**

## 4 Discussion

High-sensitivity CRP utilizes ultrasensitive detection technology in clinical laboratories. hs-CRP levels correlate with cerebral infarction volume and neurological deficit severity, serving as an indicator of stroke severity. IL-6 dysregulation is implicated in various diseases, with elevated levels being a hallmark clinical manifestation during disease onset. PCT serves as a key parameter for diagnosing and monitoring bacterial inflammatory infections. This study demonstrates that long-term high-dose chili pepper consumption may induce inflammatory responses. Chili pepper doses differentially affected serum hs-CRP and IL-6 levels with statistical significance. Dose-dependent effects were also observed on cerebrospinal fluid PCT levels. In conclusion, IL-6, hs-CRP, and PCT hold significant diagnostic value for clinical applications.

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