



Sex Specific Effects of *Prunella vulgaris* on Longevity Regulation

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Abstract

The sudden outbreak of COVID-19 in over 200 countries globally, brought serious effects on our daily lives. Traditional Chinese Medicine (TCM) in combination with regional characteristics has achieved remarkable results in China. *Prunella vulgaris* is one of the ingredients of commercially available canned Chinese herbal tea which demonstrated lifespan extending effect on *Drosophila* in our previous study, whereas it is unknown which ingredients contribute to it. This study used *Drosophila* as the model to explore whether *Prunella vulgaris* is the component taking effect on *Drosophila* longevity. Results showed that *Prunella vulgaris* can extend the lifespan of female flies by 10.42%, and improve their endurance under heat stress by 18.46%.

Keywords *Prunella vulgaris* · Traditional Chinese Medicine · Sex specificity

Introduction

TCM uses a combination of multiple herbal medicines for disease prevention and treatment, which is changeable and complicated. We previously found the commercially available canned Chinese herbal tea, a kind of medicinal tea, can increase longevity of *Drosophila* [1]. But it is unknown which ingredients contribute to it. *Prunella vulgaris* is one of the ingredients of the Chinese herbal tea, and has been used for the treatment of hepatitis, tuberculosis and diabetes through the ages [2]. Based on the literature, we found that *Prunella vulgaris* might be the ingredient have the potential beneficial effect.

Materials and Methods

We used *Drosophila melanogaster* wild type *Canton-S* for the experiments. Collected eclosing adult flies over an eight-hour period. Flies were mated for 48 h before sorting into male vials or female vials (40 flies *per* vial, $n=3$) on day 0 of the life span assay. The flies were maintained on a 12-h light/dark cycle in an incubator at 25 °C. To prepare the

solution of *Prunella vulgaris*, adding 1.5 g *Prunella vulgaris* to 60 mL water in a 100 mL reaction caldron at 100 °C for 3 h without stirring, using 22 µm filter to get the original supernatant for testing. Then three concentrations including original supernatant, 1:10 dilution and 1:100 dilution were tested. Flies were fed on *Prunella vulgaris* of original supernatant for 10 days used for the assay below.

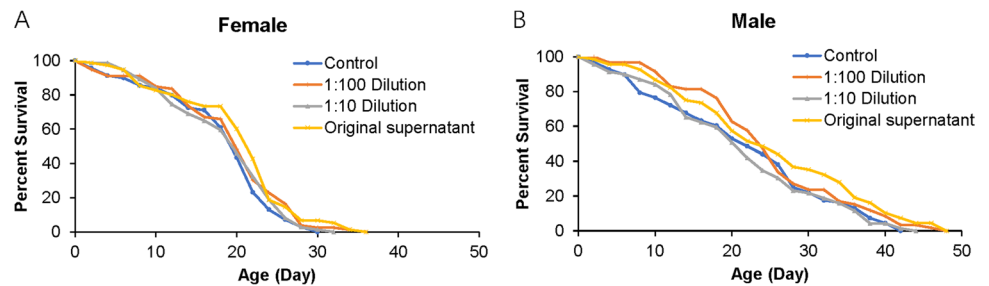
Results and Discussion

The effect of *Prunella vulgaris* on regulation of lifespan of *Drosophila* is shown in Fig. 1. When the highest concentration of *Prunella vulgaris* was supplied in the food medium, the average lifespan of female flies was increased by 10.54%, $p < 0.05$ (Fig. 1A); but it did not increase lifespan in males (Fig. 1B). As an ingredient of herbal tea, it is reasonable that the percentage of increase is not big. For the result of heat stress assay, *Prunella vulgaris* with the highest concentration can prolong the female lifespan by 18.46% ($p < 0.05$) under thermal stress (Supplementary Fig. 1), indicating that *Prunella vulgaris* reduced stress damage caused by heat stress. The results showed that *Prunella vulgaris* can prolong the lifespan of flies. But it is sex-specific. *Prunella vulgaris* did not significantly affect the food intake and 24-h activity (Supplementary Fig. 2 and Supplementary Table 1). Phytochemical studies show that *Prunella vulgaris* is rich

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Fig. 1 Effect of *Prunella vulgaris* on regulation of survival in females (A) and males (B)



in bioactive chemicals, including triterpenoids, flavonoids, phenolic acids, organic acids, sterols, and sugars [3].

Prunella vulgaris can induce the activation of nuclear factor E2-related factor 2 (Nrf2) [4]. There are also research showing that *Prunella vulgaris* extracts can enhance Hsp70 expression [5]. As heat shock proteins are prominent members of vitagene network in neuroprotection [6], and in this research we observed enhanced stress resistance, the possible mechanism of *Prunella vulgaris* on lifespan regulation could be through hormesis, the activation of the Nrf2/ARE pathway and upregulation of vitagene, including heat shock proteins. Hormetic response by phytochemicals may increase cellular protection against challenges, and promote longevity. Sex specificity was also observed in our results and it would be interesting to know how it happened. Future research to clarify the mechanisms of lifespan extension of *Prunella vulgaris* would make sense.

Supplementary Information The online version contains supplementary material available at <https://doi.org/10.1007/s11130-022-00950-x>.

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Data Availability Data is available upon request.

Declarations

Conflicts of Interest The authors declare that they have no conflict of interest.

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