

Impact of *Aloe vera* gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract on lifespan and fecundity in the model organism *Drosophila melanogaster*

Usha Rani^{1&2}, Manvender Singh² and Krishan Kumar Selwal^{1*}

¹Department of Biotechnology, Deenbandhu Choturam University of Science & Technology, Murthal, India

²Department of Biotechnology, University Institute of Engineering & Technology, Maharshi Dayanand University, Rohtak, India

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ABSTRACT

In the present study, wild-type strain Oregon-K was used to test the impact of three different plant extract on the life span of the model organism *Drosophila melanogaster*. The current study results suggest that *Aloe vera* gel is more effective in increasing *Drosophila melanogaster*'s life span than the flies fed on a standard diet. Although Ashwagandha, Brahmi, and *Cassia tora* plant extracts were also helpful in increasing *Drosophila melanogaster*'s life span, *Aloe vera* gal's effect was more significant.

Key words : *Aloe vera* gel, Ashwagandha, Brahmi, *Drosophila melanogaster*

Introduction

Longevity is a vital fitness trait governed by genetic and environmental components (Chandershekara and Shakarad, 2011). Diet plays a crucial role in affecting aging and longevity (Chandershekara and Shakarad, 2011). Many plant products are being used as food supplements. Since the last few decades, there is an upsurge in using plants in therapeutics due to their potentials as antioxidants in reducing free radical-induced tissue injury. Although plants are considered potential sources of antioxidant compounds, their in-vivo effects in model organisms like *Drosophila melanogaster* are studied poorly.

Drosophila is considered the first choice among other model organisms for investigating aging and longevity-related issues. Some of the prominent features like its short life span and easy growing and handling properties in the laboratories, genome

similarity, and presence of highly conserved metabolic pathways with eukaryotes, including humans, make *Drosophila* superior over other model organisms for investigating various genetic and metabolic pathways to avail the ground-level understanding of different gene-environment interactions and their relation to the aging process (Haddadi *et al.*, 2014; Rawal *et al.*, 2014).

The present study was focused to determine the relationship between antioxidant supplementation and life-history parameters of *Drosophila melanogaster*, which in the long run may provide a greater understanding of aging and may serve for the cure of aging-related problems in humans.

Materials and Methods

Drosophila strain, media, and culture conditions
Wild-type strain Oregon-K of *Drosophila*

melanogaster was used in the present study. The control diet for culturing the fruit flies consisted of cornflour (72g), sugar (64g), yeast (40g), and agar-agar (15g), and 1400 ml water for one liter of food. After cooking, the food media was allowed to cool to room temperature, and then propionic acid (3ml), sodium benzoate (1 g) were added and mixed thoroughly. The prepared food media, cooked as slurry, was poured into the bottles or vials and was allowed to solidify. Bottles were used to maintain stock flies, while smaller populations or experimental groups were maintained in culture vials. Flies were allowed to feed *ad libitum*. The culture was grown and maintained at 25°C with 60% humidity in 12h day-night cycle.

Collection of Plant materials and preparation of their extract:

Fresh leaves of *Aloe vera* were collected from the nearby garden in Rohtak (India). Crude pulp material was extracted in pure form and was mixed in a standard *Drosophila* diet. *Cassia tora* was collected locally, and seeds were grounded finely. Extracts were prepared in methanol (50%) and reduced by Rotary Vacuum Evaporator at 35°C. Ashwagandha and Brahmi were purchased from drug companies dealing in the field in powder form, and their extracts were prepared and standardized for use.

Experimental Design

Virgin individuals were collected in the morning hours and were housed separately, as per gender, in four replicates to perform survival and fecundity assays individually. These replicated virgin male and female individuals were further divided into control and test groups. Control groups were provided with a *Drosophila* base diet, and the test groups were supplemented with the standardized concentrations of plant extracts of *Aloe vera*, Ashwagandha, Brahmi, and *Cassia tora*. In the present studies, we used 5 ml/ml, 3 mg/ml, 5mg/ml, and 7 mg/ml concentrations of plant extracts of *Aloe vera* Gel, Ashwagandha, Brahmi, and *Cassia tora*, respectively.

Survival Assay

We observed 100 adult individuals of *Drosophila melanogaster*, both sexes, daily by feeding on control and test plants supplemented diet regimes to investigate the impact of *Aloe vera* gel, Ashwagandha, Brahmi, and *Cassia tora* plants extract supplementa-

tion on the life span of flies. The survivorship of flies was documented and measured in percentage.

Fecundity Assay

Five-day-old virgin male and female individuals from both control and test groups were allowed for mating for 12 hours in test vials with their respective food. After that, males were removed, and females were put on their respective fresh food vials. They were observed for daily fecundity from 7th to 21st day as this period is considered the standard peak period for fecundity. Deaths, if any, were observed and were recorded daily.

Results

Effect of supplementation of *Aloe vera* Gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract on longevity:

Equal numbers of males and females flies were fed on control, *Aloe vera* Gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract mixed food. The survival rates of both female and male flies were significantly affected by *Aloe vera* Gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract supplementation (Figure 1).

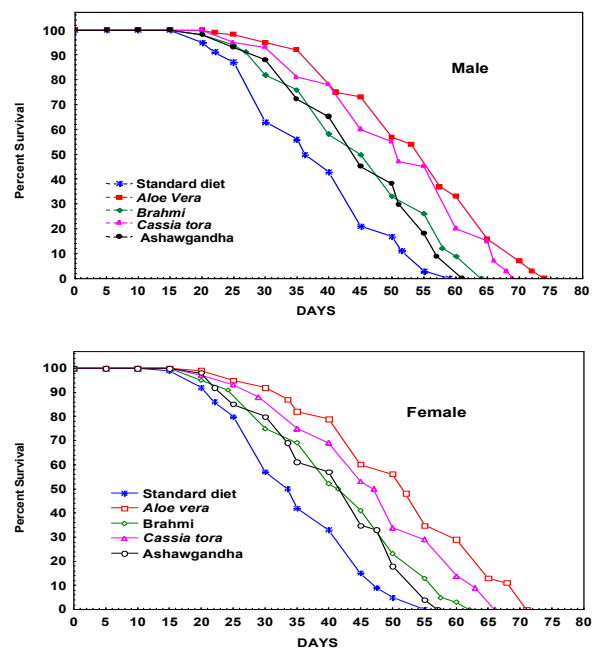


Fig. 1. Survivorship curve of *Drosophila melanogaster* fed on Control, *Aloe vera* gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract diets.

Effect of supplementation of *Aloe vera* Gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract on Fecundity in *Drosophila melanogaster*

The increase in female flies' longevity was not linked to loss of fertility as there was no significant effect of diet supplementation with *Aloe vera* Gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract on lifetime fecundity (Figure 2).

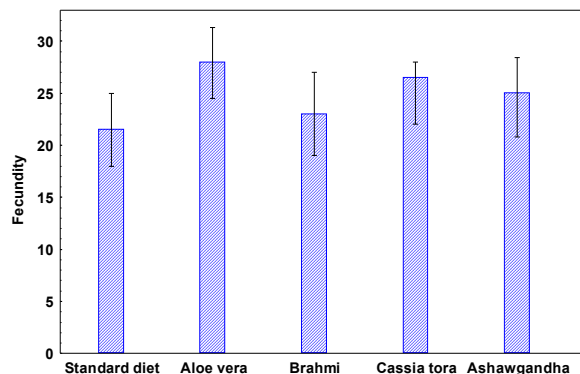


Fig. 2. Effect of *Aloe vera* Gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract supplementation on fecundity in *Drosophila melanogaster*.

Discussion

The present study found that supplemented plant extracts significantly prolonged the lifespan of *Drosophila*. The beneficial effects of dietary *Aloe vera* gel, Ashwagandha, Brahmi, and *Cassia tora* are likely due to increased SOD activity and decreased protein carbonylation (Rawal *et al.*, 2014). Diets of *Aloe vera* gel, Ashwagandha, Brahmi, and *Cassia tora* in 5ml/ml, 3 mg/ml, 5 mg/ml, and 7 mg/ml, respectively, in males and females, provided effective doses for lifespan extension and might have probably im-

proved biochemical measures related to aging. We are working to decipher the effect of *Aloe vera* gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract supplementation on antioxidant enzymes, like SOD and Catalase, in *Drosophila melanogaster*. Our results are consistent with Rawal *et al.* (2014), where supplementation of Curcumin and Amla has increased the life span of *Drosophila melanogaster*.

In summary, this study has demonstrated that lifespan extension was associated with the high nutritious value and excellent antioxidant properties of *Aloe vera* gel, Ashwagandha, Brahmi, and *Cassia tora* plant extract.

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Conflicts of Interests

There is no conflict of interests.

References

- Chandrashekar, K. T. and Shakarad, M. N. 2011. *Aloe vera* or resveratrol supplementation in larval diet delays adult aging in the fruit fly, *Drosophila melanogaster*. *The Journals of Gerontology, Series A, Biological Sciences and Medical Sciences*. 66 (9): 965–971.
- Haddadi, M., Jahromi, S.R., Sagar, B.K., Patil, R.K., Shivanandappa, T. and Ramesh, S.R. 2014. Brain aging, memory impairment and oxidative stress: a study in *Drosophila melanogaster*. *Behav Brain Res*. 1; 259: 60-69.
- Shilpa Rawal, Pavneet Singh, Ayush Gupta and Sujata Mohanty, 2014. Dietary Intake of *Curcuma longa* and *Emblca Officinalis* Increases Life Span in *Drosophila melanogaster*. *BioMed Research International*. vol. 2014, Article ID 910290, 7 pages.