



CODEN [USA]: IAJPBB

ISSN: 2349-7750

**INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES**Available online at: <http://www.iajps.com>

Research Article

**INVITRO EVALUATION OF FEW METAL COMPOUNDS ON
DROSOPHILA MELANOGASTER: A KEY FACTOR IN
REDUCING FITNESS**Priyadarshini. P. A^{1*}, Amulya. S², Chaitra. T. D³, Harishmitha. N⁴, Mohitha. S⁵¹Asst. Professor, Department of Genetics, Vijaya College, R.V. Road, Basavangudi,
Bengaluru – 560 004^{2,3,4,5} (U G students), Department of Genetics, Vijaya College, R.V. Road Basavangudi,
Bengaluru – 560 004**Abstract:**

Metals and metal ions play an important role in biological processes like growth, metabolism and other biochemical processes. In our present study, Drosophila melanogaster was used as a model organism to study the effects like growth rate, fertility, viability, morphological changes and other chromosomal aberrations.

The flies were subjected to different concentration of metal sulphates like MgSO₄, CuSO₄, Al₂(SO₄)₃ and FeSO₄ which were dissolved in rava-jaggery media. However, there was great variation in growth rate with the compounds like CuSO₄, Al₂(SO₄)₃ and FeSO₄ but could see remarkable morphological changes with increase in the growth rate of flies grown in the media containing compounds MgSO₄.

Mg²⁺ ions play a vital role in approximately 300 enzymatic reactions within the body. Along with vigorous growth many morphological changes were also observed in wings, eyes, sex comb and abdominal region of adult flies.

Since there are a few similarities between mammals and Drosophila melanogaster, an attempt was made to investigate the developmental aspects with few metal compounds which gave a clear view on how they promote or interfere the viability of the organism in their habitat.

Key words: Metal sulphates, Growth, Metabolism, Fertility, Mg²⁺, Drosophila melanogaster.

Corresponding author:**Priyadarshini. P. A,**

Asst. Professor,

Department of Genetics,

Vijaya College, R.V. Road,

Basavangudi,

Bengaluru – 560 004

QR code



Please cite this article in press P. Ramesh Kumar Reddy and D. Swathi., *Current Trend In Prescribing Pattern of Antihypertensive Drugs in A Teritiory Care Teaching Hospital: A Prospective Observational Study*, Indo Am. J. P. Sci, 2018; 05(03).

INTRODUCTION:**Metals and metallic compounds:**

Many numbers of chemicals are available commercially, for which little or no toxicological data are available. Chemicals especially metals and metal compound causes stressful effect on animal physiology. A small trace of metal does not cause much physiological changes than larger quantities.

Furthermore, continued exposure to the environmental stress of metals and metal based compounds causes persistent toxication without any knowledge of its harmful effects [1]. Studies have shown that the effects of chronic developmental exposure of these toxins are more pronounced than the acute adult exposure [2].

In 2010 Laura M.P. *et al.*, [3] quoted that zinc is less toxic under physiological condition but at higher concentrations may bind to inappropriate sites in proteins or other cofactors and interfere with their functions.

DROSOPHILA MELANOGASTER:

Drosophila melanogaster, being a model organism in genetics provides a most suitable experimental tool to understand various morphological and physiological statuses when grown in media containing metal and metallic compounds.

Since *Drosophila melanogaster* has very short life of about 2-3 weeks with large number of progeny, it provides insights about the complex homeostatic mechanisms.

Homer and Hart (1983), showed that experimentation with *Drosophila* has been quite diverse, ranging from the measurement of a single component of fitness to overall fitness based on the long term reproductive success. However Neetu *et al.*, (2014) [4] showed that stress is one of the main factors in interfering the stamina of an organism and heavy metal intoxication is one of them.

MATERIAL AND METHODOLOGY:

Wild type *Drosophila melanogaster* were cultured in the normal laboratory conditions on rava agar media

(100g sooji, 100g jaggery, 10g agar and 7.5 ml propionic acid in 1000ml distilled water) with regular sub-culturing and maintaining of the stock.

Few metal compounds such as $MgSO_4$, $CuSO_4$, $Al_2(SO_4)_3$ and $FeSO_4$ of different concentration weight (0.02g, 0.04g, 0.06g, 0.08g) were mixed in media to understand the growth rate, fecundity, viability, sex comb, sex ratio etc. Three day old flies were inoculated into the bottles and allowed to lay eggs. Three replicates per concentration weight were conducted for the above mentioned compounds. Total flies transferred at the beginning of the experiment and their mortality rate were recorded at a regular interval of 7 days to observe the growth rate.

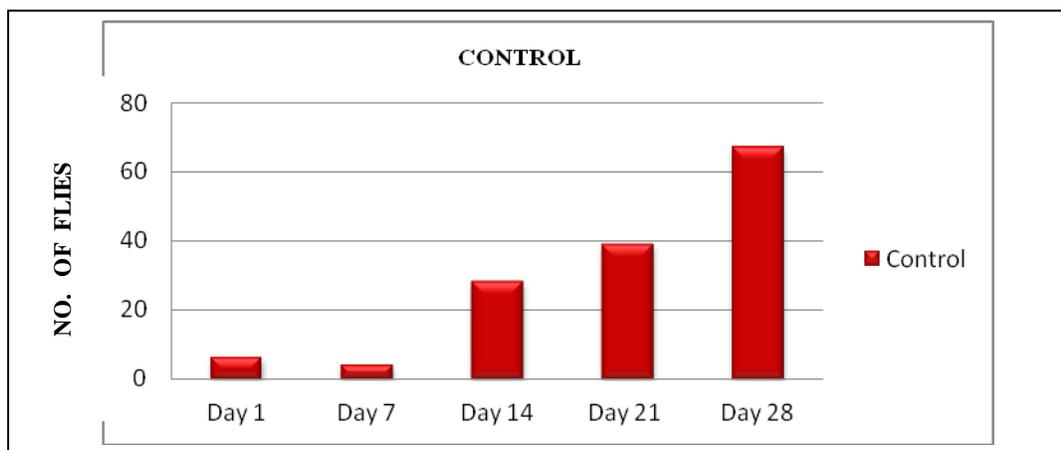
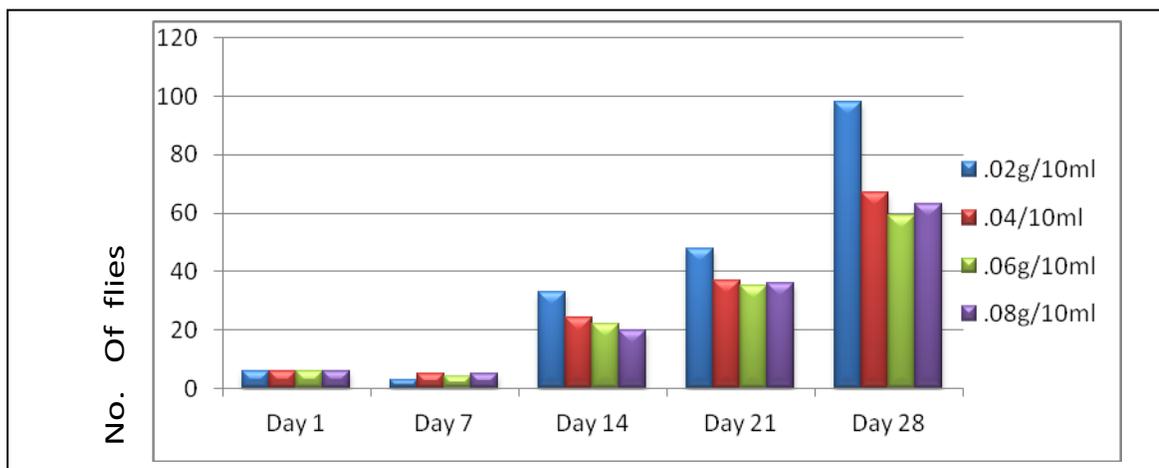
Morphological changes in adult flies were observed under the microscope by anaesthetizing the flies with chloroform. The numbers of sex comb in adult males were counted and were recorded by comparing with the wild flies followed by counting the number of males and females for sex ratio.

RESULTS AND DISCUSSION:

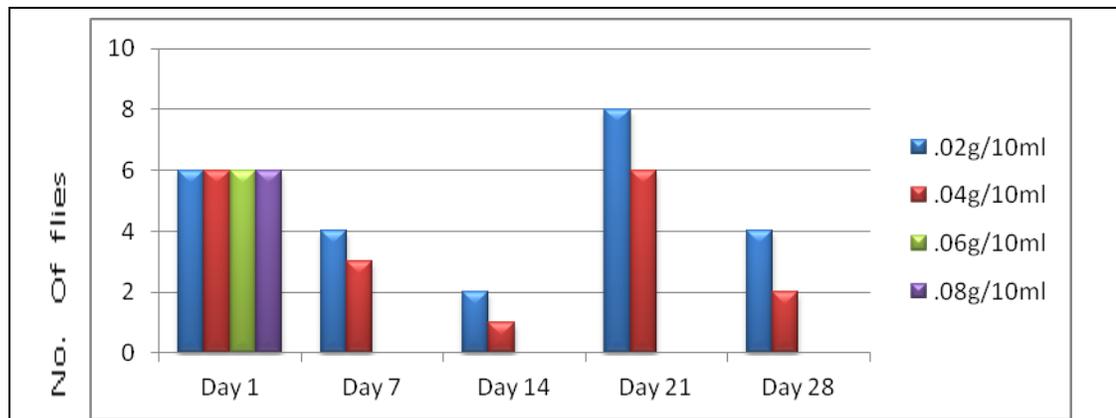
Pollutants play an important role in the environmental hazards. One such environmental pollutant is heavy metals which is associated in soil, food and in some traces in other components of our daily source. This is causing a serious threat to our life and deteriorating human health. Our experimental work with *Drosophila melanogaster* has shown metallic compounds play a major role in overall activity and a main key factor for reducing fitness which is discussed under each factors of development.

GROWTH RATE

When growth rate was considered and compared with normal flies, it was found vigorous growth was seen in media containing $MgSO_4$. *Drosophila melanogaster* grown in 0.02g/10ml concentration showed higher growth than the other concentrations (.04, .06, .08g/10ml). So it was clear that the optimum concentration of $MgSO_4$ for growth is 0.02g/10ml (Graph-1 & Graph-2).

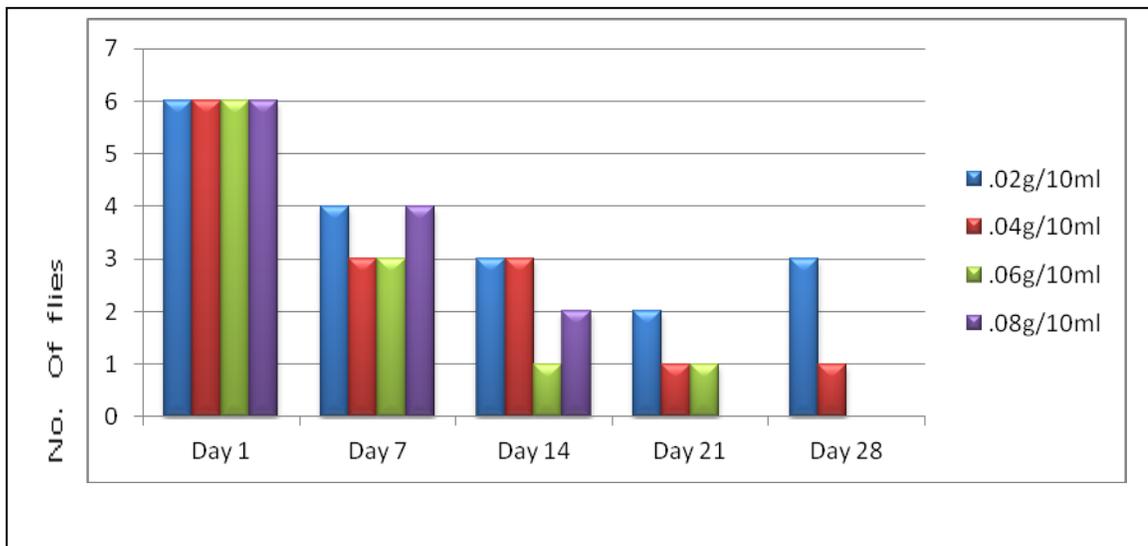
Graph-1: Growth Rate Of Flies Under Normal Laboratory Condition**Graph-2: Growth Rate of Flies In The Presence Of MgSO₄.**

Whereas in the metallic compound of CuSO₄ containing media at low concentrations (.02,.04g/10ml) prolonged the fly development especially within the larval stages. At higher concentrations (.06,.08g/10ml) was lethal due to failure of pupation Graph-3

Graph-3: Growth Rate of Flies In The Presence Of CuSO₄

Further more, in the compounds of $\text{Al}_2(\text{SO}_4)_3$ and FeSO_4 ; the pupation at low concentrations was significantly better. The overall growth was comparatively lesser than control. High number of larval death was seen in media containing FeSO_4 . With survival of a few flies with shorter life spans Graph-4.

Graph-4: Growth Rate of Flies In The Presence Of FeSO_4 & $\text{Al}_2(\text{SO}_4)_3$



Therefore its clear and our result coincide with the result of D' Souza *et al.*,2015,where they have showed that increase in the concentration of lead and zinc decreases the growth rate of the organism.

VIABILITY AND FERTILITY

The flies treated with MgSO_4 shows vigorous growth in all concentrations (0.02 ,0.04, 0.06 ,0.08g) and this indicates a very high viability and fertility. Those treated with $\text{Al}_2(\text{SO}_4)_3$ showed a average growth rate in all concentrations (0.02 ,0.04 , 0.06 ,0.08g) and this indicates good viability and fertility .Whereas in metal compounds like FeSO_4 and CuSO_4 high

number of larval death and prolonged pupation is seen, this indicates a low viability and fertility. Our result coincides with the result of Ling Ding and Yu feng Wan. 2006 [5].

MORPHOLOGICAL CHANGES

MgSO_4 treated flies show great variations in the wings structure at higher concentration, they seem to be folded or cut at different region of wing border. The eyes were bigger and oval shaped resembling a rugby ball. Whereas flies in $\text{Al}_2(\text{SO}_4)_3$ no changes were observed. CuSO_4 treated flies showed highly reduced and wrinkled wings.(Fig-1 & Fig-2) [6-9].

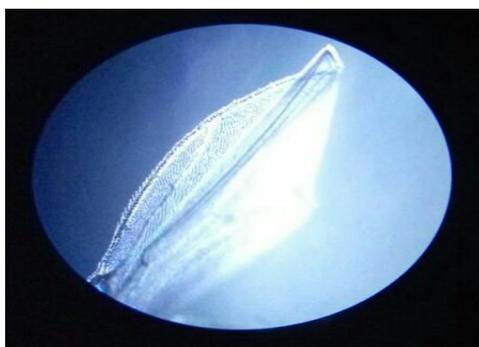


Fig-1: Folded wings of flies In presence of MgSO_4



Fig-2: Eye shape of *Drosophila* in the presence of $MgSO_4$.



Fig-3: Changes in the abdominal region of *Drosophila melanogaster*

CONCLUSION:

From the present investigation, it is clear that metals play a vital role in the metabolic activities of living organism thereby effecting growth, development, morphological changes, viability, fertility and also fecundity of the organism when consumption of metal compounds in higher concentration. Further work can be carried out in the genetic level so also to understand the molecular aspects.

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