

Effect of organic fruits (chikku and watermelon) on pre adult fitness in *Drosophila melanogaster*.

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Abstract: Nutrition consumed by an organism provides energy for growth, development, reproduction and survival of an organism. Pre – adult development is one of the important stages in the survival of an organism. In the present study flies of *D. melanogaster* reared in organic fruits (chikku and watermelon), non organic fruits and wheat cream agar media showed significant influence on feeding rate and pre adult development. The larvae had consumed significantly greater quantity of organic fruits, Further organic fruits had significant influence on egg to larva; pupa to adult whereas non significant influence in larva to pupa viability. Thus, these studies suggest that organic fruits chikku and watermelon had pre adult fitness benefit in *D. melanogaster*.

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Keywords: nutrition; organism; energy; growth; development; reproduction; survival; adult; flies; *D. melanogaster* organic fruit; wheat; cream agar media

Introduction

Studies have shown that both external and internal environmental factors known to affect organism's growth, development, reproduction and survival (Andersson, 1994). Diet is one of the important external environment know to affect the development of an organism through the variations in nutrient consumed by an organism (Sisodia and Singh, 2012; Wafa and Krishna, 2015). The effect of diet can be broadly classified into two types, that is quantitative effect which is dependent on the quantity of food taken by an organism. Qualitative effect depends on the nutrients present in the diet (Sisodia and Singh, 2012).

Now a day there is growing trend in all the aged group, i.e. The consumption of organic fruits and vegetables are greater over non organic fruits and vegetables (Chabbra et.al., 2013). This is because non organic fruits and vegetables contain pesticides which has got a detrimental effect on an individual health. Studies have also shown high levels of pesticide may increase risk of developing cancer, such as prostate cancer (Alavanja et.al., 2003). In contrast to this, organic fruits contain very less pesticides due to they are reared under natural fertilizer, which does not include pesticides (Baker et.al., 2002). In the recent studies using organic fruits and vegetables Chabrra et.al., (2013) and Wafa and Krishna (2015) have shown beneficial effect of organic fruits and vegetables using *Drosophila* as a model organism. However, they did not study organic Chikku and watermelon for their studies, Therefore more studies are required, which involves different types of organic

fruits are warranted to draw a general conclusion about the health benefits of organic fruits. Therefore present study has been undertaken in *D. melanogaster* using organic fruits namely Chikku and Watermelon to study its effect on pre adult development.

2. Materials and Methods**2.1. Establishment of Stock**

The experimental stock of *D. melanogaster* was established from the progenies of 150 naturally inseminated females which were collected at Chamundi Hills, Mysore, India. In each generation flies obtained from these culture bottles were mixed together and redistributed to 20 different culture bottles containing wheat cream agar media (100g of jaggery, 100g of wheat powder, 8g of Agar was boiled in 1000ml of double distilled water and 7.5ml of propionic acid was added). Twenty flies per culture bottle (10 males and 10 females) were used to culture flies. These flies were maintained at 22^o C±10 C with a relative humidity of 70% in a 12 hrs dark: 12 hrs light cycle. This procedure was carried out for three generations to acclimatize flies to lab condition. At fourth generation, eggs were collected using Delcour's procedure (1969). Eggs (100) were seeded to each culture bottle containing wheat-cream agar media / organically grown fruits based media / non organic (conventionally) fruits based media (1kg of fine paste of organically / conventionally grown chikku or watermelone was boiled in 1liter of double distilled water containing 10% Agar. To this 7.5 ml of propionic acid was added). When the pupae were formed, females and males were isolated and were

allowed to eclose and were aged for five days to test for virginity. These flies were used for present experiments. Organic fruits were purchased from organic food product distributors, Hasiru Organic Shop, Mysore which is a unit of Karnataka State Natural Farming Movement.

Quantification of Food intake in Larvae using Dye method

Ten Second instar larvae obtained from normal media were placed in a vial containing normal /organic and non organic fruit media containing 2.5% (w/v) blue food dye (FD & C Blue Dye no. 1). The larvae were allowed to feed for 15 minutes. Then the larvae were transferred to Eppendorf tube and frozen. These frozen larvae were homogenized by adding 200 µl of distilled water further 800 µl of distilled water was added. The observance was measured at 629 nm using a calorimeter. The larvae which were not treated with blue dye used as the blank. The amount of food taken was measured from the standard graph made from serial dilution of a blue dye.

2.3. Organically grown fruits (chikku and watermelon) effect on pre adult development of *D. melanogaster*

Eggs were obtained using Delcour's procedure (1969) to study the effect of the organic and non organic fruits based media on pre adult development. Eggs (100) were seeded separately into each vial containing 5ml of respective media (wheat-cream agar media/ organic and non organic fruits media). A total of 10 trials, was made and eggs were observed for its viability such as egg to larvae, larvae to pupae and pupae to adult. Separate experiments were performed for wheat-cream agar media/ organic fruits based media/ non organic fruits based media. The percentage of eggs in larval hatching, larval to pupal viability and pupae to adult eclosion were calculated.

Result

Figure 1 shows the quantity of food taken by larvae in different types of media. It was found that the larvae which were grown in organic fruits based media (chikku and watermelon) had consumed more amount of food compared to larvae which were grown in non organic fruits based media and wheat cream agar media. One-way ANOVA followed by Tukey's Post Hoc test carried out using SPSS version 14.0 on the above data showed significant variations in feeding rate between different type of media. Larvae consumed significantly greater quantity of food in organic fruits (chikku and watermelon) than in non organic and wheat cream agar media by Tukey's post hoc test.

Figure 2 shows data of egg to larval viability. It was noticed that percentage of egg to larvae viability was greater in organic fruits based media (chikku and watermelon) than non organic and wheat cream agar media. The sequence of egg to larvae viability as follows organic fruits (chikku and watermelon) >non organic>wheat cream agar based media. One way ANOVA followed by Tukey's post hoc test showed significant variation. Tukey's post hoc test showed that percentage of egg to larvae viability was significantly greater in larvae grown in organic chikku and watermelon than they grown in non organic chikku and watermelon and normal media (table)

Data of percentage of larvae of pupal viability is presented in Figure 3. It was noticed that the percentage of larvae to pupal viability was highest in larval fed on wheat cream agar media, while it was lost in larvae grown on non organic fruits based media. Further percentage of larva to pupal viability was greater in larvae fed on organic chikku and watermelon compared to they grown on non organic fruits. Above data was subjected to One way ANOVA followed by Tukey's post hoc test showed significant variation in percentage of larvae to pupal viability between different fruits based media. Percentage of larvae to pupal viability was significantly greater in larvae grown in organic fruits (chikku and watermelon) compared to non organic and wheat cream agar media by Tukey's post hoc test (table)

Figure 4 provides data of the percentage of pupa to adult viability in different media. It was found that percentage of pupa to adult viability was greater in both organic fruits based media (chikku and watermelon) and wheat cream agar media than non organic fruits based media. One way ANOVA followed by Tuckey's post hoc test showed significant variation in percentage of pupa to adult viability was non significantly different than organic fruits (chikku and watermelon) and wheat cream agar based media (table)

Discussion

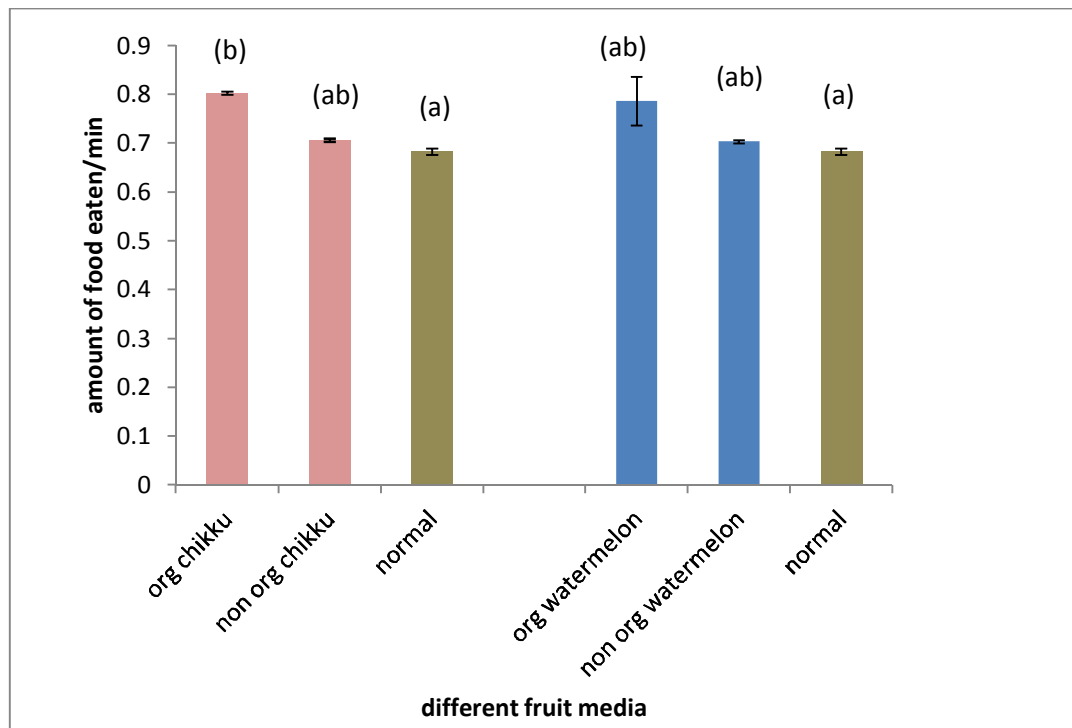
Species of *drosophila* forms very good model to investigate whether organic foods healthier for consumers because of the low costs associated with fly research and the flies short life cycle, researches use fruit flies to study human diseases from diabetes to heart function to Alzheimer's disease Chabbra et.,al(2013). To study the beneficial and detrimental effect of organic grown fruits (chikku and watermelon) on pre adult fitness of *D. melanogaster*. In the present study fruit flies were fed a diet made out of fruits (organic / non organic) to study its effect on pre adult development.

Figure 1 and Table show amount of food intake by an larvae in different diets. It was found that larvae

fed on organic fruits had consumed significantly greater amount of food than larvae fed on non organic fruits and wheat cream agar based media. This suggests the influence of organic food on the feeding rate in *D. melanogaster*. Our study also confirms the work of Chabbra et.,al(2013) and Wafa and Krishna (2015) who while working in *D. melanogaster* have also found larvae in organic fruits had consumed greater quantity of food. In studies of *drosophila* it was also shown an inhibition threshold when consuming new or four tasting foods (Melcher et al 2007). However, such inhibition had not been seen in our study, since the rate of larval feeding was significantly greater in organic fruits.

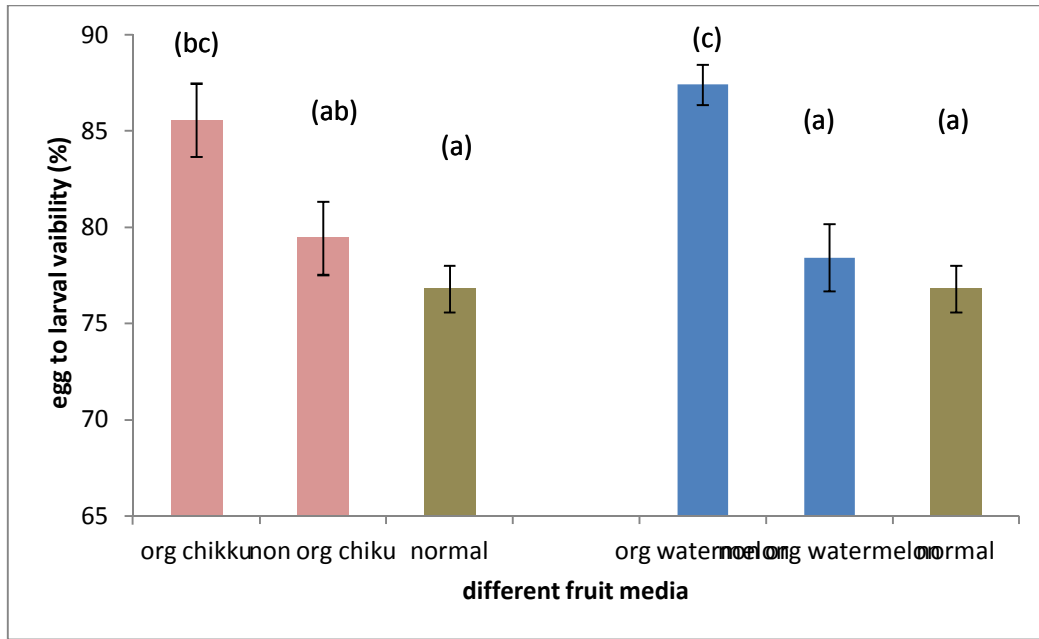
The fitness of an organism is assessed both in terms of pre adult and adult fitness. In the present study significant influence of organic fruits on pre adult development. Organic fruits had significant

influence on the egg to larval viability. However % of larva to pupae viability was found to be more or less same in both organic fruits and normal based media. Further of pupa to adult viability was found to be higher in organic fruits based media. When comparisons between organic and non organic fruits, it was found that pre adult viability was significantly greater in organic fruits, suggesting beneficial effect of organic fruits on pre adult fitness in *D. melanogaster*. Our result also confirms the work of Chabbra et al., (2013) Wafa and Krishna (2013) while working with *D. melanogaster* using Potatoes, Soybeans, raisins, Banana and Pappya have also health benefit of organic fruits. Thus, these studies suggest that eating organic chikku and watermelon had significantly greater pre adult fitness in *D. melanogaster*.



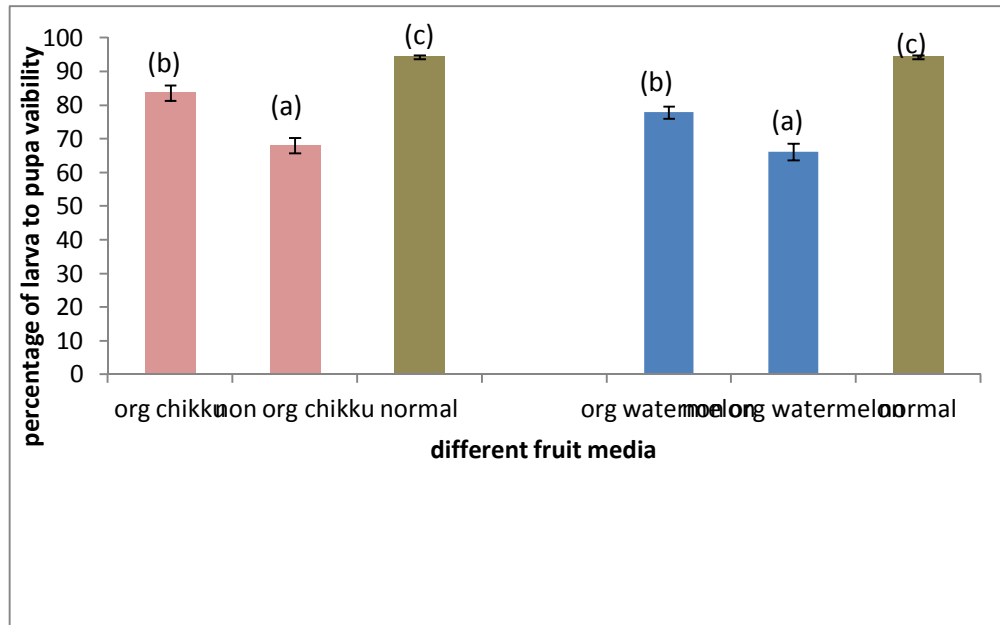
Different letters on the bar graph indicate significance at 0.05 level by Tukey's Post Hoc Test

Figure 1. Organically grown fruits' (chikku and watermelone) effect on larval feeding of *D. melanogaster* using dye method



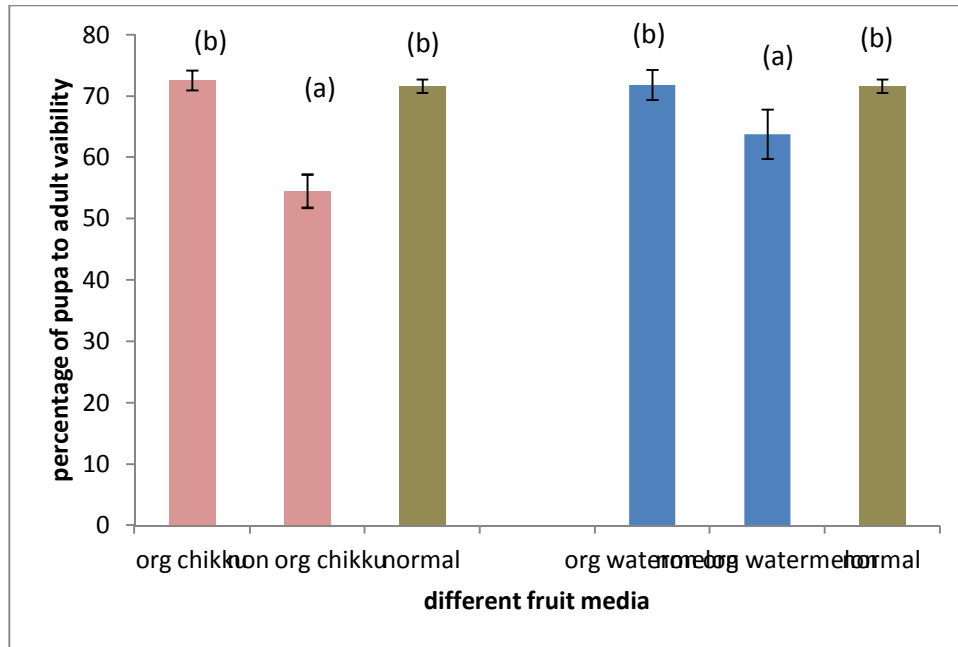
Different letters on the bar graph indicate significance at 0.05 level by Tukey’s Post Hoc Test

Figure 2. Organically grown fruits’ (chikku and watermelone) effect on egg to larval viability of *D. melanogaster*



Different letters on the bar graph indicate significance at 0.05 level by Tukey’s Post Hoc Test

Figure 3. Organically grown fruits’ (chikku and watermelone) effect on larva to pupa viability of *D. melanogaster*



Different letters on the bar graph indicate significance at 0.05 level by Tukey's Post Hoc Test

Figure 4. Organically grown fruits' (chikku and watermelone) effect on pupa to adult viability of *D. melanogaster*

Table 1. One way ANOVA of 'organically grown fruits (chikku and watermelon) effect on different parameters of *D. melanogaster*

Dependent variable	Fruits	Source	Sum of squares	Df	Mean square	F-Value
Larval feeding in(μ g)	Chikku	Media	0.024289	2	0.012144	182.1667**
		Error	0.0004	6	6.67E-05	
		Total	0.024689	8		
	Watermelon	Media	0.018022	2	0.009011	3.557018*
		Error	0.0152	6	0.002533	
		Total	0.033222	8		
Pre adult development Egg to larval viability	Chikku	Media	404.9169	2	202.4585	7.017838*
		Error	778.9263	27	28.84912	
		Total	1183.843	29		
	Watermelon	Media	652.2781	2	326.139	17.62042**
		Error	499.7473	27	18.50916	
		Total	1152.025	29		
Larvae to pupal viability	Chikku	Media	3494.586	2	1747.293	50.25379**
		Error	938.7733	7	34.76938	
		Total	4433.36	29		
	Watermelon	Media	4013.983	2	2006.991	62.2853**
		Error	870.009	7	32.22255	
		Total	4883.992	29		
Pupae to Adult viability	Chikku	Media	2061.491	2	1030.745	27.55732**
		Error	1009.899	7	37.40368	
		Total	3071.39	29		
	Watermelon	Media	422.4274	2	211.2137	2.713455**
		Error	2101.664	7	77.83939	
		Total	2524.091	29		

*P<0.05level;** P<0.0001 level

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