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The Effects of the Jeeni Millets Traditional Mix on the Sex Ratio of the *Drosophila Melanogaster*

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Abstract

The nutritional diet is one of the important external environmental factor which effects on the growth and development, stress resistance, survivability, reproductive fitness and also alters the sex ratio. In the present study the flies of *D. melanogaster* flies are cultured in the wheat cream agar media, Jeeni millet media and mixed media to understand the effect of Jeeni millet traditional mix on sex ratio in *D. melanogaster.* The results revealed that the female offspring are produced more than the male offspring of in all the three diets. The Jeeni millet flies produced the more females and less male offspring compared to the Wheat cream agar diet which produced the less females and more male offspring as well as mixed diet shown the average production of male and female offspring. Thus, suggests that the nutritional dietary components in the food alters offspring sex ratio in *D. melanogaster*.

Keywords: Nutrition, Jeeni millet, *Drosophila melanogaster*, Sex ratio

Introduction

Sex ratio in animals is known to be influenced by a number of factors, both genetic an Environmental. Deviations from a theoretical 1:1 ratio of males and females may be caused by factors producing changes in the primary sex ratio or by factors operating subsequent to fertilization and causing changes in the secondary sex ratio. The study of sex ratio in insects has been one of the important topics in evolutionary biology (Leigh *et al*., 1985) [5]. In insects with separate sexes, the sex ratio is the proportion of male or female progeny produced. The proportion of females indicates reproductive potential of a population. Norm ally, in a randomly mating population, sex ratio varies around 1:1 because of the segregation of sex chromosomes during gametogenesis (Rawlings and Maudlin, 1984; Werren and Godfray, 1995; Hoy, 2004) [10, 15, 4] and this 1:1 sex ratio generally indicates stabilising selection on males and females (Schowalterl,1996) [11].

In many organisms with the sexes are separate, females are produced in approximately equal numbers with males. (Hardy, 2002) [3]. Therefore, in many organisms, such as insects, the sex ratio is 1:1 Prakahs, (2008) [9]. This ratio maximizes the availability of males to females, and hence maximizes genetic heterogeneity Schowalter, (2016) [12]. However, several environmental factors ultimately affect sex ratios. The environmental factors affecting sex ratio can from physical, chemical, or biological factors Schowalter, (2016) [12] and Hardy (2002) [3]. In the several study, the effect of some physical factor on sex ration in D. melanogaster were studied. Those physical factor are environmental temperature, minimum light condition, and electromagnetic field (EMF) radiation. Dietary nutrition is one of the major external environmental factors regulating population growth.

In insects, reptiles, and birds, sex-ratio adjustments in response to food availability and other environmental factors, e.g., extreme sex-ratio skewing due to male-selective killing by Wolbachia infection in the Samoan butterfly, *Hypolimnas polina* have long been characterized.

In nature, there are many animals that create a biased sex ratio among its offspring due to many different reasons and thus male or female-biased sex ratio is found in the wild. This affects the life history traits of both males and females. Organisms change their mating behaviour to survive in adverse conditions when a biased sex ratio arises. This affects their efficiency of gender roles in both males and females which they modify in order to achieve fitness in adverse conditions.

D. melanogaster was used as a model organism in this study. The organism was choosen in this study because of some reasons. First, *Drosophila* is an organism that produced consistently high numbers of offspring. Second, this organism is recorded as rapid breeder with a lot of eggs and short life cycle. Third, this organism has often been as model organism in many studies examining various problems in biology. (Neethu *et al.,* 2014) [8].

Millets are nutri-cereals, which are known to be exceptionally nutrient-dense and high in protein, carbohydrates, essential fatty acids, dietary fiber, B vitamins, and minerals including

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calcium, iron, zinc, potassium, and magnesium. Millets include significant nutrients such as resistant starch, oligosaccharides, lipids, antioxidants such phenolic acids, avenanthramides, flavonoids, lignans, and phytosterols, which are thought to be responsible for a number of health advantages (Miller 2001; Edge *et al.,* 2005) [6, 2]. In addition to minerals and vitamins, it contains phenolic components such phenolic acids, flavonoids, and tannins as well as insoluble fiber and peptides, carbs, and protein-rich foods.

The jeeni millet health mix has the following nutritional value per 100g: 69.4g of carbohydrates, 13.57g of protein, 399Kcal of calories, 7.49g of fat, 110mg of calcium, 4.5g of iron, and 0.6g of natural sugars.

Now a days the people are enormously consuming the Jeeni Millet traditional mix by all age people due it's nutritional and health benefits. The several studies shows that the consumption of the millet would reduce the diabetes, control the blood pressure, also helps in the wound healing and also shows the positive effects on controlling the cardiovascular diseases etc. in different model organism, but there is no evidence documented about how the millets effects on the sex ratio of the organism. Therefore, the study is under taken to address the effect of Jeeni millet traditional mix on the sex ratio in the *Drosophila melanogaster*

Materials Method

The jeeni millet traditional health mix was purchased from the Apollo pharmacy shop, Jayalakshmipuram, Mysuru, Karnataka, India. Used for prepare the experimental media.

Establishment of Stock: Experimental Oregon K strain of *D. melanogaster* used in the study was collected from *Drosophila* stock centre. Department of studies in Zoology, University of Mysore, Mysore and this stock was cultured in bottles containing wheat cream agar media (100g of jaggery 100g of wheat powder,10g of Agar was boiled in 1000ml distilled water and 7.5 ml of propionic acid was added). Flies were maintained in laboratory conditions such as humidity of 70% and 12 hours dark 12 hours light cycles and temperature 22 ^{0}C ± 1^{0}C.

The flies obtained as above were used to establish the experimental stock with different diet media[Wheat cream agar media: Wheat cream agar media was prepared from 100g of jaggery, 100g of wheat rava powder, 10g of agar boiled in 1000ml dilstilled water and 7.5 ml of propionic acid added to it.; Jeeni millet traditional mix (Refered as Jeeni millet) media: Jeeni millet media was prepared from 100g of jaggery, 100g of Jeeni millet traditional mix powder, 10g of agar boiled in 1000ml of distilled water and 7.5 ml of propionic acid added to it; Mixed(Wheat cream+ Jeeni millet (1:1) media): Mixed media is prepared from 100g of jaggery, 50g of wheat cream powder and 50g Jeeni millet mix powder,10g of agar boiled in 1000ml of distilled water and 7.5 ml of propionic acid added to it.] The flies emerged from the wheat cream agar media and other experimental treated media were maintained under the same laboratory conditions as mentioned above and were used to study the sex ratio experiments in *D. melanogaster.*

Sex Ratio Experiments: The virgin male and female flies were collected from the wheat cream agar, Jeeni millet and mixed diets. Allow to mating, after mating, these mated pairs were transferred to vial containing their respective media, once in seven days until their death. And note down the males and females offsprings emerged from each diet and experiments continued until the death of the flies. A total of twenty pairs were made separately for each of the wheat cream agar and Jeeni millet and mixed media.

Results and Analysis

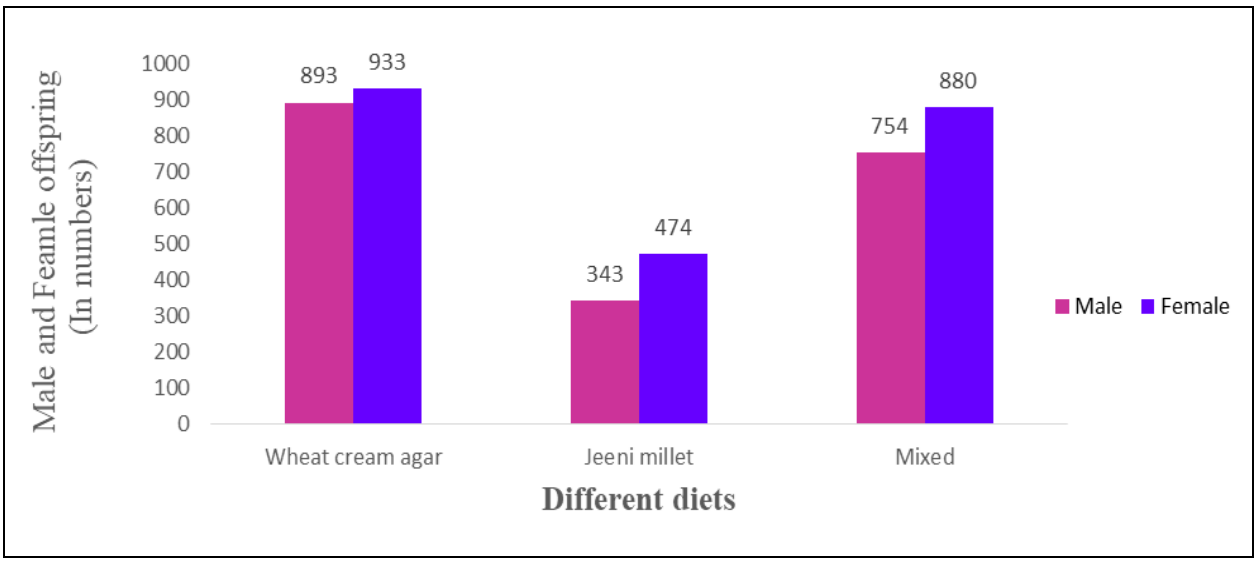

Fig 1: The graphs showed the comparison between the male and female adult filial numbers in *D. melanogaster* raised on the different diets (Wheat cream agar, Jeeni millet, Mixed)

The Figure 1 suggests that the female offspring are produced more than the male offspring in all the three diets. When the data subjected to the Chi square analysis showed the no significant between the male and female sex ratio in all the three diets.

Table 1A: The effect of wheat cream agar, Jeeni millet and Mixed diet on the male offsprings sex ratio of *Drosophila melanogaster.*

Treatment(diets)	No. adults	No. females	No. males	F:M ratio
Wheat cream agar	1826	933	893	1:0.96
Jeeni millet	817	474	343	1:0.70
Mixed	1642	880	754	1:0.85

Table 1B: The effect of wheat cream agar, Jeeni millet and Mixed diet on the female offsprings sex ratio of *Drosophila melanogaster*.

Treatment(diets)	No. adults	No. females	No. males	M:F ratio
Wheat cream agar	1826	933	893	1:1.04
Jeeni millet	817	474	343	1:1.30
Mixed	1642	880	754	1:1.15

Table 1C: The effect of wheat cream agar, Jeeni millet and Mixed diet on the female and male offsprings sex ratio of *Drosophila melanogaster* and Chi square analysis value.

Treatments	F:M ratio	Chi square value	Significant
Wheat cream agar	1.04:0.96	0.0032	P>0.05
Jeeni millet	1.30:0.70	0.1800	P>0.05
Mixed	1.15:0.85	0.0450	P>0.05

Discussion

There are several studies reveals that the physical factors like temperature, photoperiod effects on the sex ratio in insects including *D. melanogaster* but as per our knowledge of information our study is the first report on the effects of Jeeni millets traditional mix diet on the sex ratio in *D. melanogaster*.

The nutritional diet is one of the important external environmental factor which affects on the growth and development, stress resistance, survivability, reproduction and also alters the sex ratio. The Jeeni millet traditional mix contains the various nutrients (per 100 g) such as 69.4g of carbohydrates, 13.57g of protein, 399Kcal of calories, 7.49g of fat, 110mg of calcium, 4.5g of iron, and 0.6g of natural sugars. Therefore present study has been undertaken in *D. melanogaster* to know the effect of Jeeni millet traditional mix on Sex ratio in the *D. melanogaster*. In the present study, the (Figure 1) results revealed that the females off springs were produced more than the male off springs in all the three diets. This is because the quality and quantity of the diet is influence on the variation in the sex of the off springs. Several studies have been demonstrated that diet quantity and quality influences maternal reproductive output and sex of the organism. According to the Yazgan (1972) [16], the increase in amino acids in the diet increases the number of female individuals of *Pimple thirunallar* (endoparasitoid). Parent flies prefer the production of a particular sex in their progeny that increases the possibilities of survival for that species, by assisting them in reproduction or decreasing the competition for mates, habitats and resources. Besides these factors, sometimes the sex of the offspring also depends upon the health of the mother (Trivers and Willard, 1973) [13].

Offspring sex ratios were strongly affected by maternal diet, the date of oviposition and their interaction. Quality of food eaten by reproducing females not only influences maternal reproductive output but also modifies the size and sex of offspring. In general females fed the high-quality diet produced female-biased sex ratios and those on the low-quality diet produced male-biased sex ratios. In our study the according to the obtained male and female ratio,(Table A to C) the flies fed with Jeeni millet produces the more female offsprings and less male offsprings compared to the wheat cream agar diet raised flies which produces the less female off springs as well as the more male off springs further the flies fed with the mixed diet showed the average of production male and female off springs. The Jeeni millet nutritional diet rich with the protein and carbohydrates contents with some amount minerals this may alters the physiology of the flies and results the variation in the sex ratio compared to wheat cream agar and mixed diet. Our study also supported by the Maternal diet quality also influenced clutch sex ratios. Females maintained on the low-quality diet produced male-biased clutches, whereas those on the high-quality diet produced female-biased clutches. And the lack of nutrient food results the significant reduction in the number of females compared with the male offspring of *A. quadridentata* (Fater *et al.,* 2014) [7]. and also in laboratory mice, the diet with high fat and low carbohydrates contents results the Production of male than the female off springs as well as when the diet is supplemented with the calories in the form carbohydrates rather than the fat results the production of female off springs than male. Wiebe and Bortolotti (1992) reported that in American krestels, *Falco sparverius*, whenever, food resources are unlimited, high numbers of female progeny are produced. The variation in the dietary sucrose(carbohydrates), Lipids, Vitamin, protein (Amino acids) results the variation in the sex ratio of the *Pimple turionellae*, (Mustafa *et al.,* 2005) [1].

There are several research showed that the variation in the environmental factors such has the temperature, light, Variation in the age also alters the sex ratio of in the several insects including the *D. melanogaster.* However in our experiments we used the same aged flies raised on the different diets which maintained under same environmental condition were used to study the sex ratio hence the observed variation in experimental results is due to the variation in the quality and quantity of the nutrients in the diet.

Conclusion

Hence from our study in *D. melanogaster* we can conclude that the nutrition is one of the key factors influenced on the sex ratio of the organism. The jeeni millet diet increases production of the female offsprings than the male offspring than the wheat cream agar and mixed diet.

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