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Mass Gainer Increases Longevity in *Drosophila melanogaster*

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Abstract

By using wheat cream agar media, 10g of mass gainer media and 20g of mass gainer media *Drosophila melanogaster* were cultured. The experiment was analysed to determine how mass gainer effect the longevity of the flies.

By carrying out our experiment we came to know that flies raised in 20g of mass gainer media had longer lifespan whereas flies raised in 10g mass gainer had average longevity but flies raised in wheat cream agar media had shorter lifespan. Further our study revealed that female flies had longer longevity than male flies whereas virgin female flies had greater longevity than unmated female flies. Our study proves that mass gainer increases longevity in *D. melanogaster*.

Keywords: Diet, longevity, *D. melanogaster*, mated

Introduction

An important extrinsic factor that can affect an organism's survival, growth, and development is its diet (Sisodia and Singh, 2012). It has been shown that in a range of taxa, including mammals and nematode worms, dietary restrictions without starvation impact longevity and reproductive output. Studies have demonstrated that nutrition plays a significant role in life expectancy and fertility (Piper *et al*, 2011). There are two categories for how an organism's diet affects its life history traits: quantity, which is determined by the availability of food, and quality, which is determined by the nutritional content of food (Sisodia and Singh, 2012). It's been shown that nutritional changes extend the longevity of numerous animal species, including flies.

The lifespan of wild animals is influenced by a multitude of factors, including intrinsic features like ageing rates and extrinsic factors like predation, starvation, and other environmental conditions. Longevity is a quantitative trait that is influenced by genes that alter nutrition signalling pathways and numerous fitness traits. Lifespan is a quantifiable characteristic that depends on several factors, such as environment, sex, age, and genetic makeup (epigenetics) (Paaby and Schmidt, 2009). Numerous traits, such as lipid content, development time, body size, biochemical defences, and resistance to environmental stressors (starvation, desiccation, and cold), are frequently associated with longer lifespan in *Drosophila*. These associations can be positive or negative (Vermeulen and Loeschcke, 2007; Wit *et al*., 2013; Deepashree *et al*., 2017).

Ageing, according to Finch (1990) and Charlesworth (1994), is the progressive loss of an organism's functional capacity that leads to its demise. Though many theories have been proposed to account for the fitness and reproduction-related evolutionary factors that impact the longevity of a species (Hughes and Reynolds, 2005).

The average lifespans of the sexes differ in many species, with females frequently outliving men (Lints *et al*, 1983; Austad and Fischer, 2016) [12, 2]. The observed disparities in lifespan between the sexes are often derived from wild populations and are ascribed to sexual competition, eating patterns, and risk-taking behaviour, all of which may not be directly related to differences in intrinsic ageing rates between the sexes (Austad and Fischer, 2016) [2]. According to the sexual selection theory (Trivers, 1972) [22], there are disparities in ROS generation and antioxidant defences across sexes as a result of a trade-off between lifetime investment and reproductive effort.

A powdered supplement called a "mass gainer" mixes protein and carbohydrates and is typically used to enhance body mass (Campbell *et al*, 2008). A mass gainer, sometimes referred to as a "weight gainer," is a powder designed to take the place of meals in order to increase muscle mass. Most mass gainers are heavy in fat, protein, and carbohydrates to promote an energy excess and the synthesis of muscle protein. Mass gainers may also contain extra muscle-building ingredients like beta-hydroxymethylbutyrate (HMB) and creatine monohydrate to expedite the healing process.

Protein powders are a well-liked and widely used supplement among athletes that help with skeletal muscle growth and repair, general health enhancement, and post-exercise recovery. It is also recommended that athletes increase their muscle mass and refrain from breaking down proteins during prolonged exercise (Memet *et al*, 2014). While some scientists think that taking too many protein supplements

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could be detrimental to one's health, others do not. A related study found that taking supplements and eating a lot of protein may be detrimental to kidney function (Baskan and Sezen, 2023).

These days, mass gainers are used by a lot of people, particularly body builders and athletes, because of their advantageous effects on nutrition and health. Although many studies have shown that mass gainer consumption can increase protein synthesis, increases in muscle protein net balance, and increases body weight, among other benefits, in various model organisms, there is no published data on how mass gainer impacts an organism's ability to withstand the cold or other environmental stresses (Campbell *et al,* 2008). Thus, the purpose of this study is to ascertain how mass gainer affects *D. melanogaster's* longevity.

Materials and Methods

The mass gainer was purchased through Flipkart App from A207, Lane No. 9, No. 4, Mahipalpur, Delhi, 110037, India. This mass gainer was used to 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 cream rava,10g of agar was boiled in 1000 ml 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 and 12 hours light cycles and temperature 22°C ± 1°C.

Establishment of Experimental Stock

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 cream rava, 10g of agar boiled in 1000ml distilled water and 7.5 ml of propionic acid added to it.

20g of Mass Gainer Media: is prepared from100g of jaggery, 80g of wheat cream rava, 20g of mass gainer powder, 10g of agar boiled in 1000ml of distilled water and 7.5 ml of propionic acid added to it.

10g of Mass Gainer Media: is prepared from 100g of jaggery, 90g of wheat cream rava and 10g of mass gainer 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 under the same laboratory conditions as mentioned above were used to study the longevity experiment in *D. melanogaster.*

Effect of Mass Gainer on Longevity in *D. melanogaster*

Five days old unmated male and female flies from wheat cream agar, 10g of mass gainer and 20g of mass gainer media were taken to conduct longevity experiments. Five unmated female flies from each media were taken in separate vials containing respective media. On every seventh day, these flies were transferred to other vials containing respective media until the death of each fly. Every day the number of flies were noted and the number of dead flies were noted. A total of ten flies were observed separately for each of wheat cream agar, 10g of mass gainer and 20g of mass gainer media. Separate experiment was carried out for virgin and mated female, unmated males and mated males in *D. melanogaster.*

Results and Discussion

Analysis of Survival Curve

Survival curve was calculated for longevity of males and females. Two functions that are dependent on time are of particular interest: the survival function and hazard function. The survival function S(t) is defined as the probability of dying at time t having survived until that time. The graph of S(t) against t is called survival curve. The Kaplan-Meir method was used to estimate this curve from observed survival times without assuming an underlying probability distribution. Two survival curves were compared using a statistical hypothesis test called the log-rank test, which is used to test null hypothesis that there is no difference between survival curves i.e., the probability of an event occurring at any point of time is for each media 20 trials were made for each of the wheat cream agar,10g mass gainer and 20g mass gainer diet. Separate experiment was carried out for virgin female, mated female, mated male and unmated males in *D. melanogaster*.

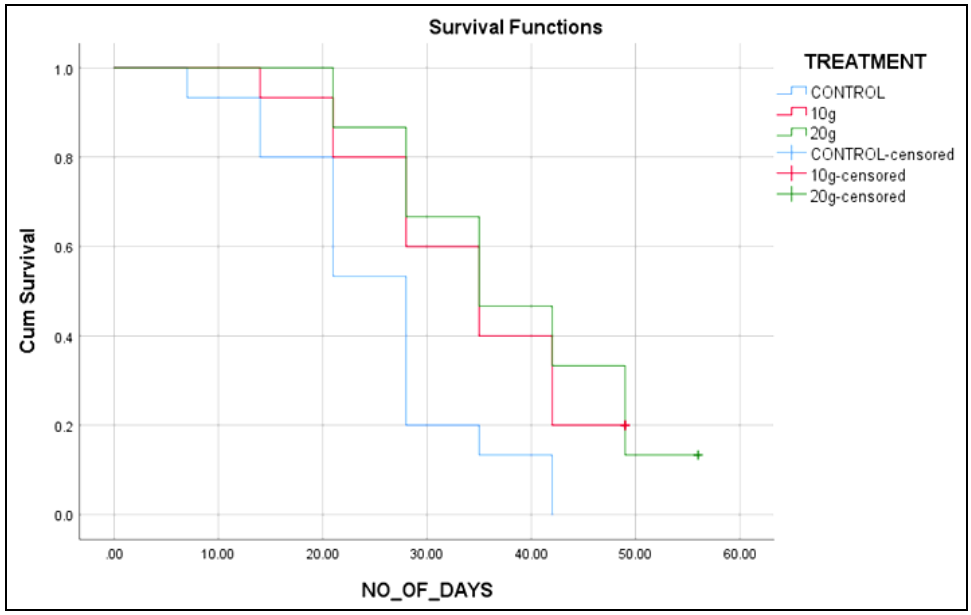

Fig 1: Effect of Mass gainer on the longevity of mated male in *D. melanogaster*

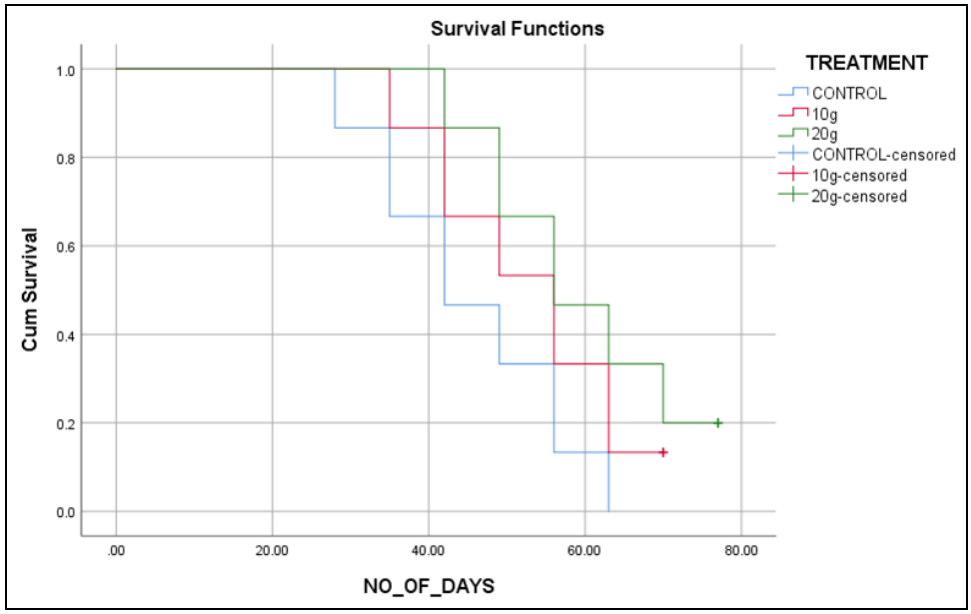

Fig 2: Effect of Mass gainer on the longevity of the mated females in *D. melanogaster*

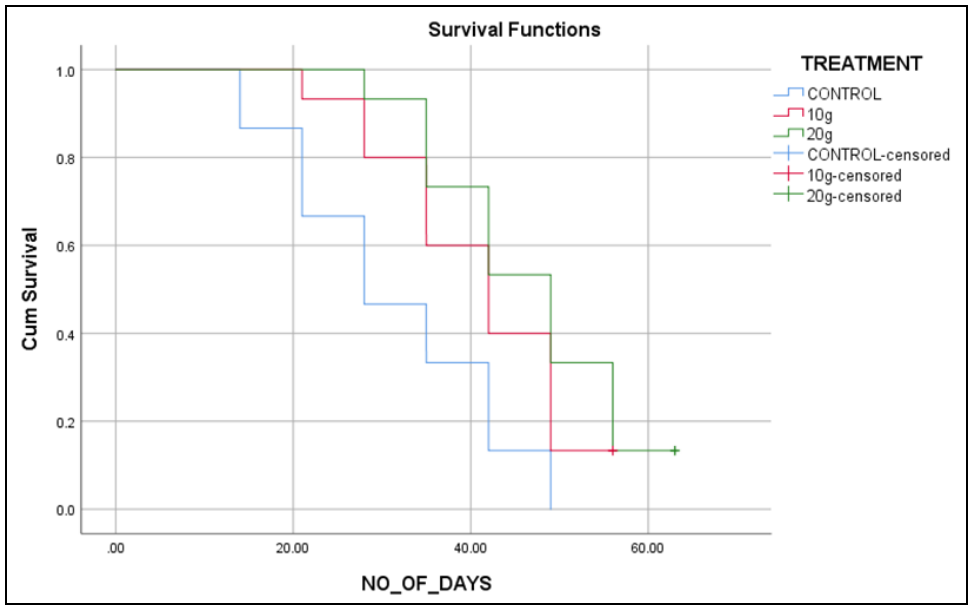

Fig 3: Effect of Mass gainer on the longevity of the virgin male in *D. melanogaster*

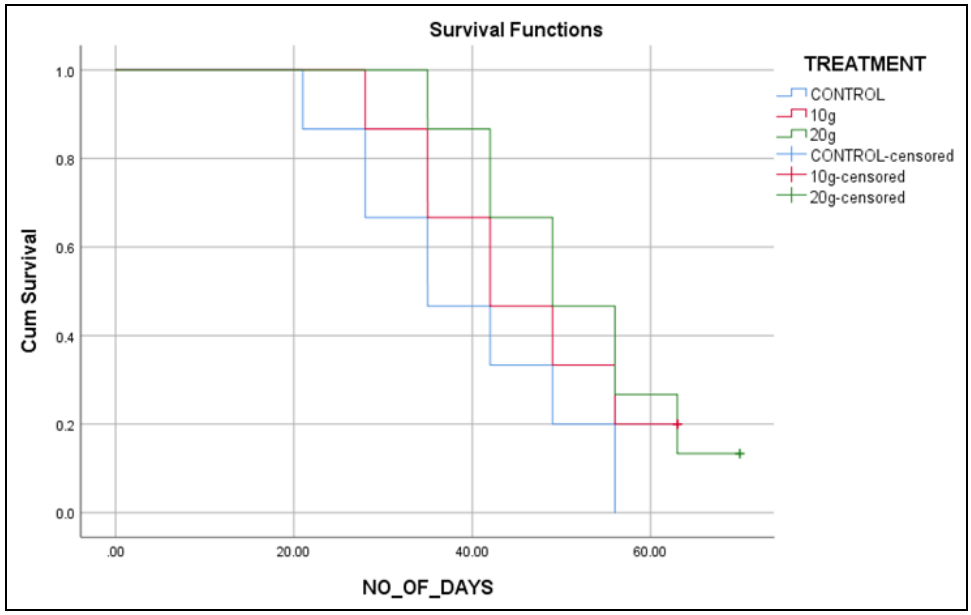

Fig 4: Effect of Mass gainer on the longevity of the virgin female in *D. melanogaster*

Figures 1 to 4 shows how *D. melanogaster's* lifespan varied depending on the mass gainer supplement and control media concentrations. It was discovered that the flies' mass gainer supplement feeding rate was lower than that of the control medium flies. This implies that the longevity rate is significantly impacted by mass gainer supplements. Variation in lifetime duration is a significant life history characteristic as it discloses the *Drosophila* lifespan and the extent of nutrient consumption by an organism (Wafa and Krishna, 2015; Alwyn and Krishna, 2015) [23, 1]. For instance, dietary protein intake, which can range from extremely low to extremely high, has a significant impact on lifespan in a variety of species (Partridge *et al*, 2005; Piper and Partridge, 2007).

According to Figures 1, 2, 3, and 4, which show the above data, flies raised on mass gainer ingested more food and survived noticeably longer than those grown on control media (wheat cream agar media) in the current investigations. Furthermore, flies raised in control media showed the least longevity. This is due to the mass gainer supplement's high nutritional content, which included fibre and carbohydrates, but which is absent in wheat cream agar medium and has a detrimental effect on longevity. However, the nutrients in mass gainer might sustain extended life, as seen by the noticeably longer lifespans of flies raised on various mass gainer supplement dosages.

Research findings indicate that a high carbohydrate and low protein diet are necessary for an optimal life span, meaning that the food consumed affects the longevity of *Drosophila*.

The findings of (Tatar *et al*, 2014) [21], which indicate that the ratio of protein to carbohydrate intake determines *Drosophila* longevity, support our findings. In example, it has been demonstrated that in adult *Drosophila*, the ratio of carbohydrates to proteins, or sugar to yeast, frequently plays a significant role in determining adult lifespan (Lee *et al*, 2008). The results of Lee *et al.*, 2008 who discovered that response surfaces for fecundity and lifespan were optimized at different protein-carbohydrate intakes, with egg-laying rate peaking at a ratio of 1:12 and longevity reaching its optimum at a ratio of 1:16, are supported by our research. The lifetime egg production statistic, which is the most equivalent to fitness, was optimized at an intermediate P:C ratio of 1:4. In our experiment we found that flies grown on wheat cream agar media had less longevity than 10g mass gainer which had an average longevity, whereas flies raised in 20g mass gainer media had greater longevity due to presence of more carbohydrates in it.

We also discovered a sex difference in longevity between flies supplemented with mass gainer and control in the current investigation (Fig 1, 2, 3 and 4). The results revealed that the female flies lived longer than male flies in all the three diet. This finding supports past research on the variations in *Drosophila* longevity according to sex. The lifespans of the sexes in many species differ, and females usually outlive men (Lints *et al*. 1983; Austad and Fischer 2016) [12, 2]. Austad and Fischer (2016) [2] state that reported differences in longevity between the sexes are often derived from wild populations and linked to sexual competition, feeding habits, and risk-taking behaviour-differences that may or may not be related to innate differences in aging rates between the sexes. According to the sexual selection theory (Trivers, 1972) [22], sex differences in ROS generation and antioxidant defences are the outcome of a trade-off between continuous maintenance and reproductive effort. The exact mechanism by which oxidative stress impacts sexual selection is yet unknown. Comparing the lifespans of the sexes within a species can be useful in understanding sex-specific aging (Austad and Fischer, 2016) [2]. Therefore, it appears from these research that *D. melanogaster* can benefit healthily from mass gainer supplements.

Male flies that mated with many female flies showed reduced lifespans. Interestingly, flies consumed less food after mating. Both sexes had less fat after mating with diverse partners (Koliada *et al*, 2020). In our study. We found that mated male had less longevity than unmated male and in contrast to other studies we found that mated female had greater longevity than unmated female.

Conclusion

So, from this experiment we can infer that female flies lived longer than male flies, further we found that mated female flies had greater longevity than unmated female flies. Flies raised in 20g Mass gainer had greater longevity than 10g Mass gainer and Wheat cream agar media.

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