ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 11, Issue, 03, pp.2063-2065, March, 2019

DOI: https://doi.org/10.24941/ijcr.34622.03.2019

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

DOES THE COMBINED GLUCOSE AND VITAMIN C NUTRITIONAL REGIMENS EXTENDS THE LIFE SPAN OF DROSOPHILA MELANOGASTER?

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ARTICLE INFO

Article History:
Received 27th December, 2018
Received in revised form
17th January, 2019
Accepted 06th February, 2019
Published online 31st March, 2019

Key Words:

Glucose, Vitamin C,
Drosophila melanogaster,
Longevity.

ABSTRACT

Back ground: In most invertebrate systems, dietary restriction is applied somewhat non-traditionally in that food quality, rather than quantity, is manipulated through dilution of the nutritional components in the medium. To clarify how these nutritional factors influence longevity, nutrient consumption and lifespan, we were measured on a series of diets with varying glucose and vitamin C content. ***Methods:*** The fly stock is assessed for this experiment is *Drosophila melanogaster*. The stock is obtained from the *Drosophila* stock centre, Mysore, India. For the dietary restriction assays, different concentrations of Glucose (3g/100ml, 5g/100ml and 7g/100ml), vitamin C (0.25mg/100ml, 0.5mg/100ml and 0.75mg/100ml) and both Glucose plus vitamin are formulated in the diet. For longevity analyses, we used the modified protocol of Luckinbill and Clare, 1985. ***Results:*** The flies fed with combination of Glucose plus Vitamin C resulted in an increased life span followed by Vitamin C and Glucose in both males and females when compared to control. However LD of Glucose fed flies have resulted significantly decreased lifespan. Interestingly female flies have shown significantly increased life span in all the concentrations. ***Discussion*:** In several studies has been demonstrated that increased intake of protein may increase protein synthesis, decrease protein breakdown, reduce fat accumulation, and increase fat-free mass. The flies fed with combination of Glucose plus Vitamin C resulted in an increased life span followed by Vitamin C and Glucose in both males and females when compared to control.

***Citation: Yarajarla Ramesh Babu.* 2019.** "Does the combined glucose and vitamin c nutritional regimens extends the life span of drosophila melanogaster?", *International Journal of Current Research*, 11, (03), 2063-2065.

INTRODUCTION

Dietary Restriction (DR) increases the life span in a variety of organisms such as yeasts, nematodes, fruit flies and mammals (Lin *et al.,* 2002; Partridge *et al.,* 2005; Walker *et al.,* 2005). It involves limiting dietary energy intake to improve health and retard ageing. In human subjects, caloric restriction has been shown to cause beneficial metabolic, hormonal and functional changes (Fontana and Klein, 2007). Dietary restriction, whereby food intake is reduced without leading to malnutrition, extends lifespan in many organisms: yeast (Kaeberlein *et al.,* 2007), invertebrates (Piper and Bartke 2008) and mammals (Weindruch and Walford 1988), including primates. In order to maximise its genetic contribution to posterity, an organism must appropriately direct the use of nutrients to traits such as growth, reproduction and repair (Richard *et al.,* 2009). Whether mechanisms of lifespan extension are conserved between humans and model organisms is unknown. The physiological mechanisms underlying lifespan extension by CR have yet to be identified.

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Drosophila melanogaster is often used as a model organism in studies of physiological and evolutionary responses to various forms of stress (Hoffmann *et al.,* 2003; Sinclair *et al.,* 2007; Kristensen *et al.,* 2008a). However, there is little information about how nutrition affects life history traits (Watts et al., 2006) and performance during stress, and the importance of diet is often underestimated in experimental designs (Prasad *et al.,* 2003). Hence, there is a growing need to investigate diet-related effects behind variation in traits of importance for fitness. Many organisms face a challenge of meeting their optimal nutritional requirements for somatic and reproductive growth under natural conditions (Raubenheimer and Simpson, 1999). During life, body tissues constantly require a specific quantity and proportion of nutrients, in order to attain optimal growth and performance (Bauerfeind and Fischer, 2005). Deficiency or imbalance of e.g. fat, carbohydrate or protein can affect characters such as somatic growth and reproduction. Adult Drosophila feed on soft rotting fruits that are rich in sucrose, fructose and glucose like. Apples, peaches, grapes and pears. In a classic series of experiments, Wigglesworth (Wigglesworth 1949) determined that these sugars provide energy for adult flight.

Table 1. Enriched food media administered to *D. melanogaster* flies

Diet→ Components↓	Control	Glucose			Vitamin C			Glucose plus Vitamin		
		LD	MD	HD	LD	MD	HD	LD	MD	HD
Water	1000ml	1000ml	1000ml	1000ml	1000ml	1000ml	1000ml	1000ml	1000ml	1000ml
Agar	10g	10g	10g	10g	10g	10g	10g	10g	10g	10g
Soji	100g	100g	100g	100g	100g	100g	100g	100g	100g	100g
Glucose	-----	30g	50g	70g	-----	-----	------	30g	50g	70g
Vitamin C	-----	------	------	------	25mg	50mg	75mg	25mg	50mg	75mg
Propionic acid	7.5ml	7.5ml	7.5ml	7.5ml	7.5ml	7.5ml	7.5ml	7.5ml	7.5ml	7.5ml
Jaggery	100g	100g	100g	100g	100g	100g	100g	100g	100g	100g

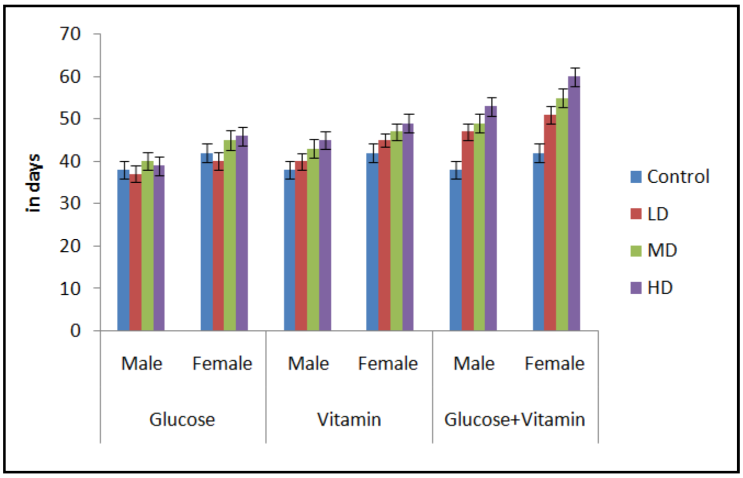

Figure 1. Mean (±SE) Longevity of *Drosophila melanogaster* on exposure to Glucose, Vitamin C and Glucose plus Vitamin C

Flies that were depleted of muscle glycogen by flying them to exhaustion, resumed flight within two minutes when fed glucose, sucrose, fructose, mannose, maltose or trehalose. In contrast, some sugars such as arabinose were completely ineffective. A similar relative value of sugars was established by Hassett 1948, who counted the number of flies that survived when provided these sugars as the sole food source. Sucrose, glucose and fructose supported survival whereas arabinose and xylose were very poor. The aim of this study was to test if larval nutrition affects the ability of adult flies to cope with a number of different nutritional stress challenges, including Glucose, Vitamin and Vitamin+Glucose. As Vitamin and carbohydrates are the most important macronutrients for *Drosophila* larvae in natural food sources (Mattson, 1980), we choose to focus on these two very different dietary regimens. In order to test how these growth media affected life span of *Drosophila melanogaster.*

MATERIALS AND METHODS

***Drosophila melanogaster* strain and culture condition:** The fly stock was assessed experiment was *Drosophila melanogaster*. The stock was obtained from the *Drosophila* stock centre, Mysore, India. The fly stock was cultured in standard wheat cream agar medium containing wheat flavour, jagarry, agar, yeast and propionic acid. Flies were cultured under uncrowded culture condition at 22±1°C (rearing temperature) and a relative humidity of 70%.

Treatment of Drosophila with selected diets: For dietary restriction assays, different concentrations of Glucose (3g/100ml, 5g/100ml and 7g/100ml), vitamin C (0.25mg/100ml, 0.5mg/100ml and 0.75mg/100ml) and both Glucose plus vitamin were formulated in the diet. The appropriate concentration of nutritional composition is mentioned in the Table 1.

Lifespan experiments: For longevity analyses, flies were maintained in vials in groups of 10 (5 females and 5 males) and transferred into new vials every 4 days. We performed five independent experiments, using 100 newly eclosed flies for each experiment. In particular, we carried out this experiment using normal food (control media), treated media containing sucrose, vitamin and Glucose plus vitamin. Longevity was assessed using the modified protocol of Luckinbill and Clare, 1985.

RESULTS

Fig. 1. The mean longevity of the dietary treated males and female flies. The flies fed with combination of Glucose plus Vitamin C resulted in an increased life span followed by Vitamin C and Glucose in both males and females when compared to control. However LD of Glucose fed flies have resulted significantly decreased lifespan when compared to control fed flies. Interestingly female flies have shown significantly increased life span in all the concentrations when compared to male flies.

DISCUSSION

Nutritional environment is a potent mediator of an organism lifespan, in particular dietary restriction has been constantly found to extend lifespan across a vast range of animal taxa including Yeast (Lin *et al*., 2002), Fruit flies (Chippidale *et al*., 199), Mice (Weindruch and walford, 1982), Rhesus monkey (Roth *et al*., 1999). The influence of distinct carbohydrates on ageing has previously been tested for several different model organisms, including the fruit fly *Drosophila melanogaster* (Diptera: Drosophilidae). One of the pioneering studies in this field was performed by Hassett (Cho *et al.,* 2011). However, in Hassett's experiment, flies fed glucose solution had a slightly shorter life span than those on sucrose.

In several studies has been demonstrated that increased intake of protein may increase protein synthesis, decrease protein breakdown, reduce fat accumulation, and increase fat-free mass (Kerksick *et al*., 2006; Piatti *et al*., 1994) has been demonstrated. The flies fed with combination of Glucose plus Vitamin C resulted in an increased life span followed by Vitamin C and Glucose in both males and females when compared to control (Feg1). Moreover, separate labs often employ divergent diet-restriction protocols involving different levels of nutrient dilution and alteration of dietary components. Fitness is multifaceted thing and the relative contributions of different traits to fitness vary in different environments and contexts. Life history evolution and population dynamics are fundamentally linked because formal life-history theory developed out of models of population growth in age-related populations (Gadgil and Bossert, 1970; Chrlesworth, 1994), and moreover, life history traits like survivor ship and fecundity and their sensitivity to density, are the major determinants of population dynamics (Mueller *et al*., 2000).

Acknowledgment

The author thank to Department of Applied Genetics, Karnatak University, Dharwad-580003, Karnataka, INDIA for providing facility to carry out the above work.

REFERENCES

Bauerfeind S.S and Fischer K. 2005. Effects of adult-derived carbohydrates, amino acids and micronutrients on female reproduction in a fruit-feeding butterfly. *Journal of Insect Physiology.* 51; 545–554.

Charlesworth B. 1994. Evolution in age-structured populations, 2nd edition. Cambridge University Press, London.

Chippindale A.K, Leroi A.M, Saing H, Borash D.J and Rose M.R. 1997. Phenotypic plasticity and selection in *Drosophila* life history evolution. *Journal of Evolutionary Biology.* 10: 269–293.

Cho J, Hur J.H and Walker D.W. 2011. The role of mitochondria in *Drosophila* aging. *Experimental Gerontoogy*. 46: 331–334.

Fontana L and Partridge L. 2015. Promoting health and longevity through diet: from model organisms to humans. *Cell*. 26; 106-118.

Gadgil M and Bossert P.W. 1970. Life historical consequences of natural selection. *Am. Nat*. 104; 1–24.

Hoffmann R, Fábián T and Dér F. 2008. Comparison of yields and nutritive value of different spring green forage mixtures. *Acta Agriculturae Slovenica, suplement.* 2:143–148.

Kaeberlein M, Burtner C. R. and Kennedy B. K. 2007. Recent developments in yeast aging. PLoS Genet. 3, e84.

Kerksick C.M, Rasmussen C.J, Lancaster S.L, Magu B, Smith P, Melton C, Greenwood M, Almada AL, Earnest C.P and Kreider R.B. 2006. The effects of protein and amino acid supplementation on performance and training adaptations during ten weeks of resistance training. *Journal* of *Strength & Conditioning Research*. 20: 643–653.

Kristensen T.N, Hoffmann A.A, Overgaard J, Sørensen J.G, Hallas R and Loeschcke V. 2008. Costs and benefits of cold acclimation in field-released *Drosophila*. *Proceedings of the National Academy of Sciences , USA.* 105:216-221.

Lin S.J, Kaeberlein M, Andalis A.A, Sturtz L.A and Defossez P.A. 2002. Calorie restriction extends Saccharomyces cerevisiae life-span by increasing respiration. Nature 418: 344–348.

Longo V.D and Mattson M.P. 2014. Fasting: molecular mechanisms and clinical applications. *Cell metabolism.* 19(2); 181-192.

Luckinbill L.S and Clare M. 1985. Selection for lifespan in *Drosophila melanogaster*. *Heredity*. 55; 9-18.

Mueller L.D, Joshi A and Borash D.J. 2000. Does population stability evolve? *Ecology*. 81: 1273–1285.

Partridge L, Piper M.D, Mair W. 2005. Dietary restriction in Dosophila. *Mech Ageing Dev* 126: 938–950.

Piatti P.M, Monti F, Fermo I, Baruffaldi L, Nasser R, Santambrogio G, Librenti M.C, Galli-Kienle M, Pontiroli A.E and Pozza G. 1994. Hypocaloric high-proteindiet improves glucose oxidation and spares lean body mass: comparison to hypocaloric high-carbohydrate diet. *Metabolism.* 43: 1481–1487.

Piper M. D. and Bartke, A. Diet and aging. *Cell Metab*. 8, 99–104 (2008).

Prasad N.G, Shakarad M, Rajamani M and joshi A. 2003. Interaction between the effect of maternal and larval nutrition levels on pre-adult survival in *Drosophila melanogaster*. *Evolutionary Ecology Research*. 5; 903-911.

Raubenheimer D, Simpson S.J and Mayntz D. 2009. Nutrition, ecology and nutritional ecology: toward an integrated framework. *Functional Ecology*. 23; 4–16.

Richard C.G, Richard W, Timothy M. B, Linda P, Matthew D. and Piper W.. 2009. Effect of a Standardised Dietary Restriction Protocol on Multiple Laboratory Strains of *Drosophila melanogaster,Plos One, 4(1),1-8.*

Roth G, Ingram D and Lane M. 1999. Calorie restriction in primates: will it work and how will we know? *Journal of the American Geriatrics Society.* 47: 896–903.

Walker G, Houthoofd K, Vanfleteren J.R and Gems D (2005) Dietary restriction in C. elegans: From rate-of-living effects to nutrient sensing pathways. Mech Ageing Dev 126: 929–937.

Weindruch R and Walford R. 1982. Dietary restriction in mice beginning at 1 year of age: effect on life-span and spontaneous cancer incidence. *Science*. 215: 1415–1418.

Weindruch R. and Walford, R. L. 1988. The Retardation of Aging and Disease by Dietary Restriction (Thomas).

Wigglesworth VB. 1949. The utilization of reserve substances in *Drosophila* during flight. J Exp Biol. 26:150–163.

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