

# Milk Fat Globule Membrane (MFGM) dietary supplementation in *Drosophila melanogaster* affects its lipid metabolism and fecundity.



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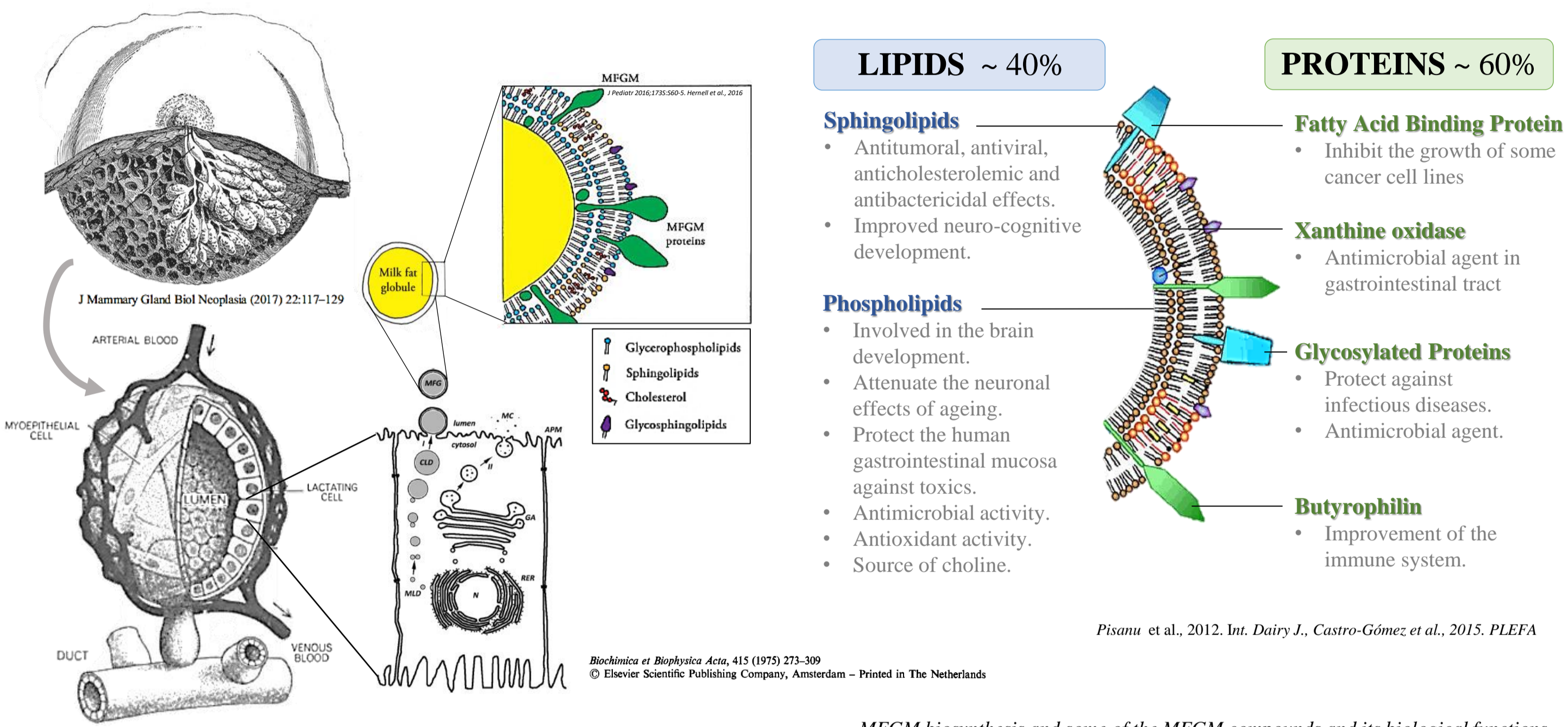
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## INTRODUCTION

### MFGM biosynthesis and composition

MFGM is a bioactive compound present in milk. It is produced by the lactating cells of the mammary gland and is organized in a lipid trilayer that surrounds the milk fat globules.



Pisano et al., 2012. *Int. Dairy J.*, Castro-Gómez et al., 2015. *PLEFA*

### MFGM and health

#### DEVELOPMENT

of the nervous system, microbiota and intestinal function during lactation

#### PREVENTION

of diseases associated with aging

#### MAINTENANCE

of the nervous system, microbiota, intestinal and cognitive functions in the adult

ANTIVIRAL, ANTIMICROBIAL, ANTIBACTERIAL, ANTITUMORAL effects

## OBJECTIVES

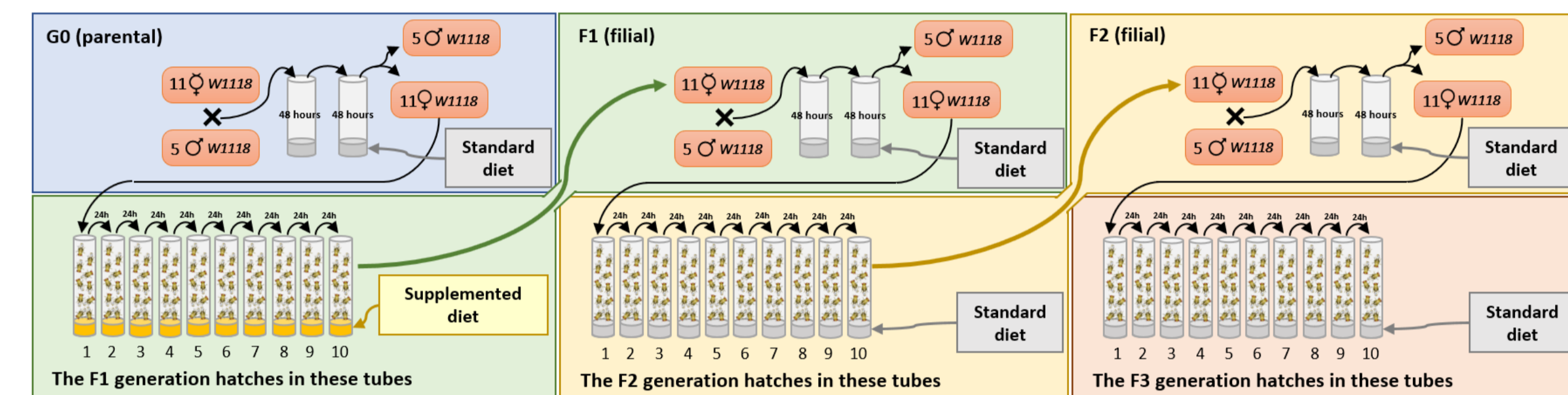
Deciphering the molecular insights underlying the effects of MFGM consumption on health by using *D. melanogaster* as a model system for dietary intervention studies.

Searching the effects of MFGM consumption thought possible changes in fecundity, life cycle, longevity, lipidomic markers and transgenerational heritability.

## METHODS

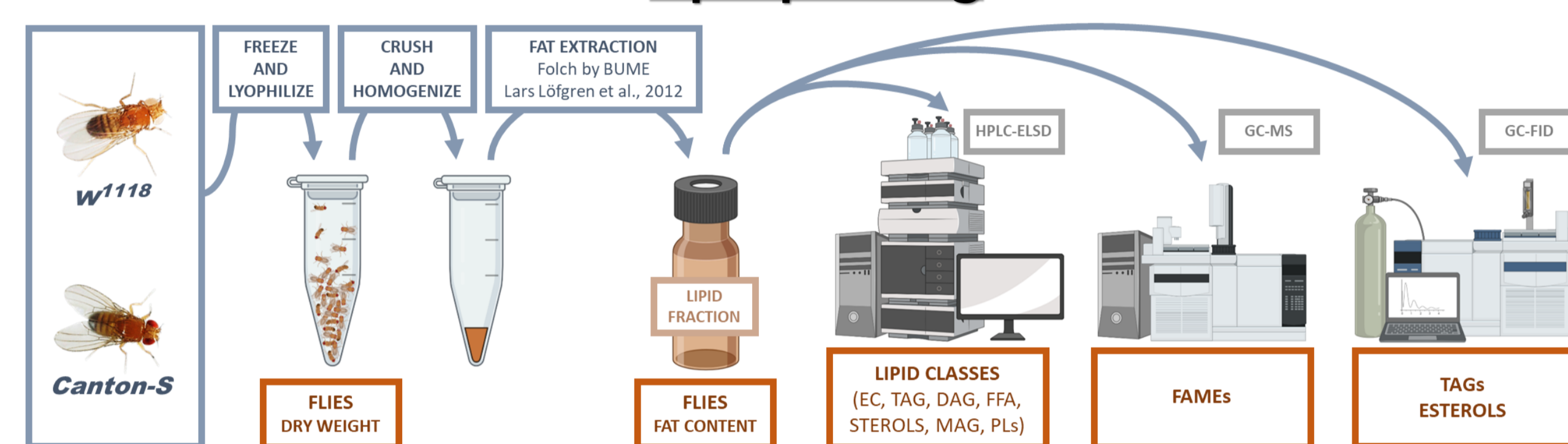
### Female fecundity, progeny life cycle and progeny viability assays

To ascertain the effect of MFGM consumption on *D. melanogaster*, we performed several tests using two different strains (*W<sup>1118</sup>* and *Canton-S*) and four different MFGM concentrations (0%, 1%, 2% and 3%).



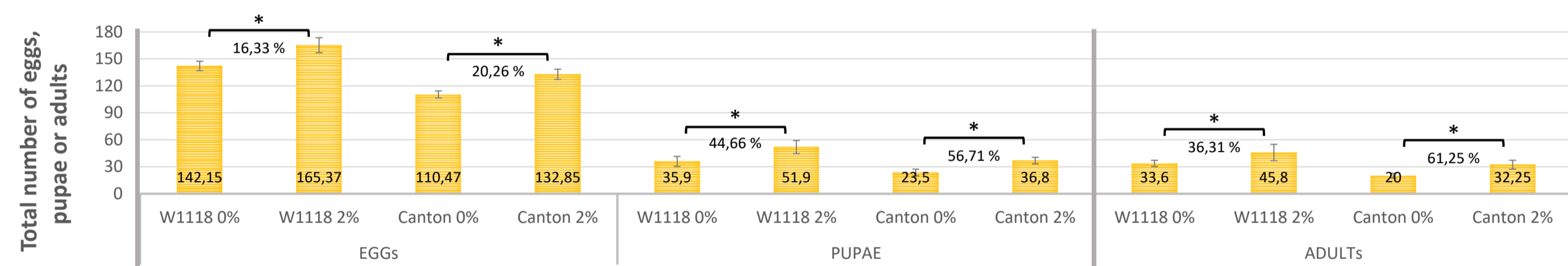
The daily number of eggs laid, pupae, and hatching adults was counted in order to calculate the female fecundity and its transgenerational heritability, the progeny life cycle and viability rate.

### Lipid profiling

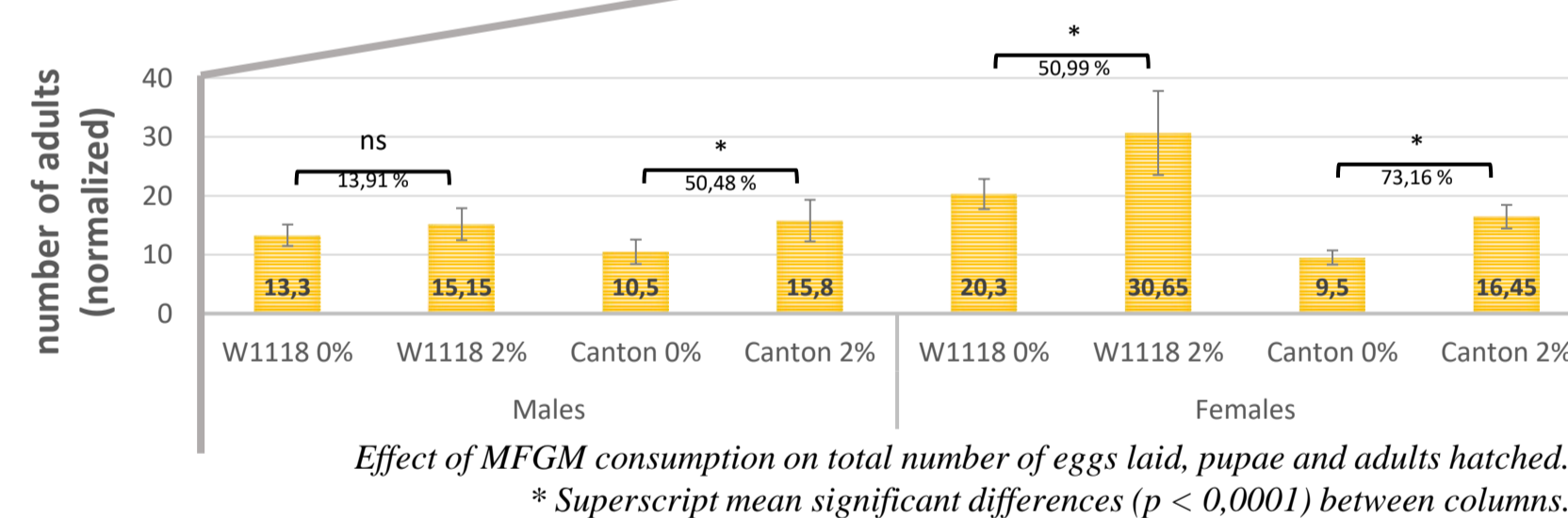


## RESULTS

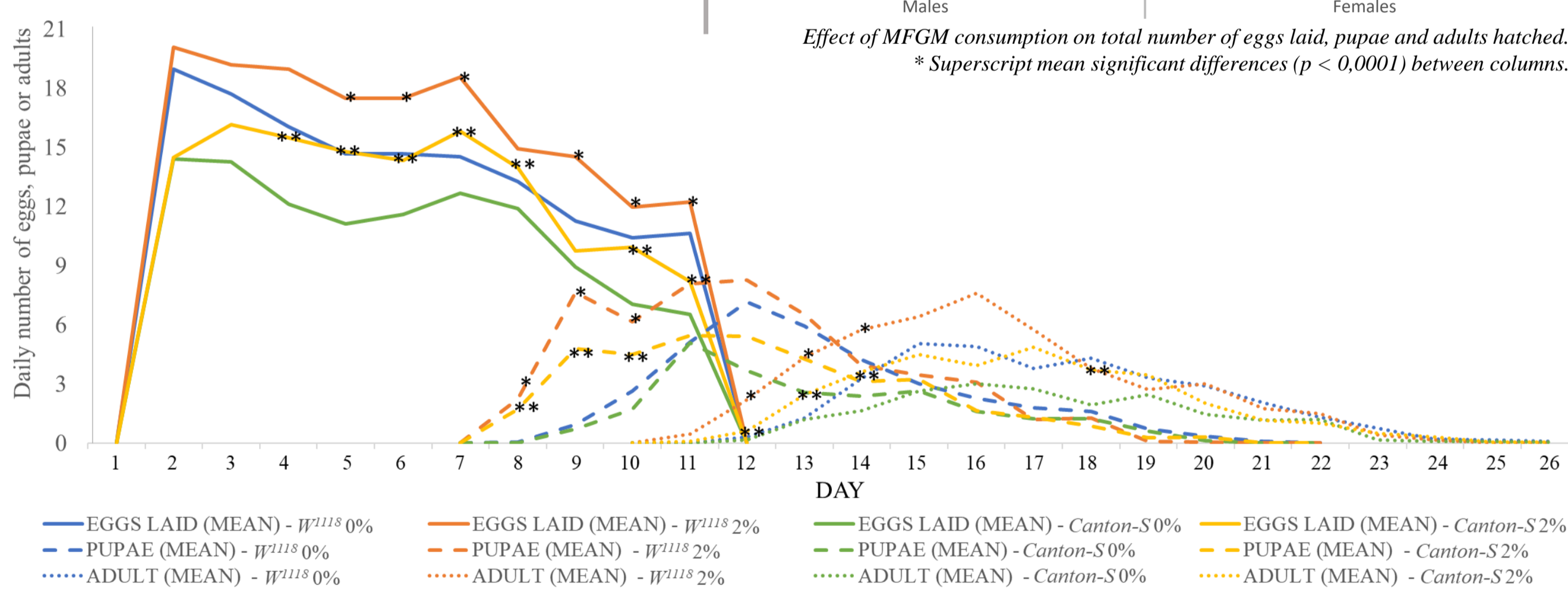
### MFGM consumption increases the fecundity of both strains...



There is a significant increase in the total number of eggs, pupae and adult in the *w<sup>1118</sup>* 2% and *canton-s* 2% groups relative to the *w<sup>1118</sup>* 0% and *canton-s* 0% groups.

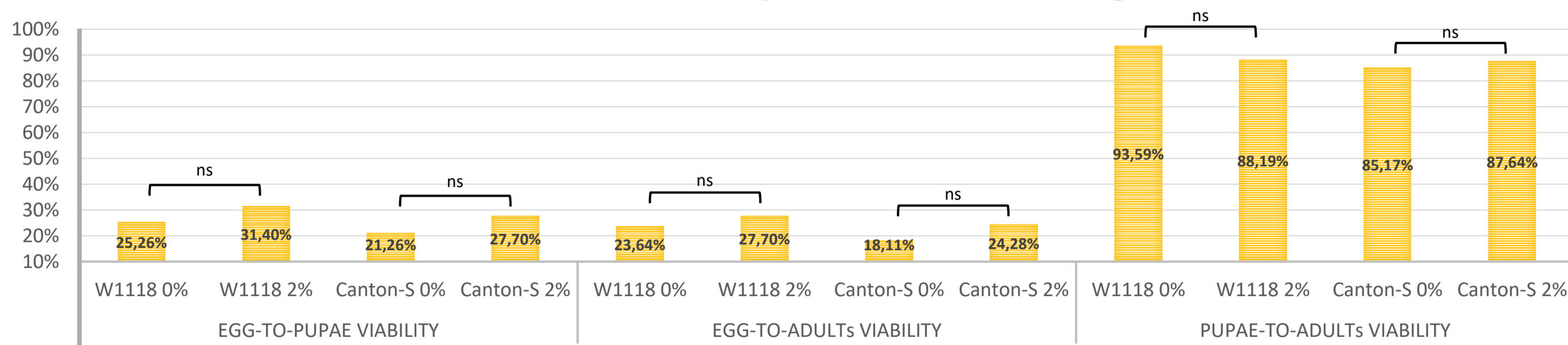


Effect of MFGM consumption on total number of eggs laid, pupae and adults hatched. \* Superscript mean significant differences ( $p < 0.0001$ ) between columns.



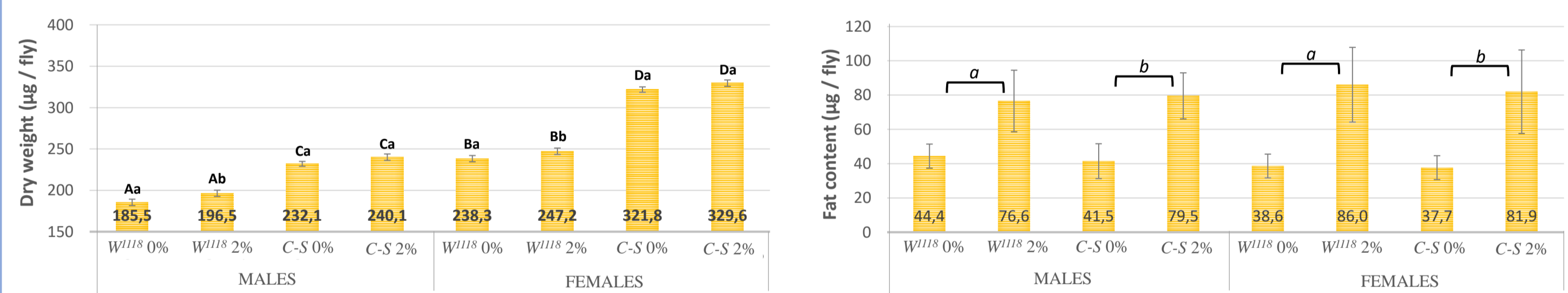
Effect of MFGM consumption on daily number of eggs laid, pupae and adults hatched. \* Superscript mean significant differences ( $p < 0.001$ ) between *W<sup>1118</sup>* 0% and *W<sup>1118</sup>* 2% for a given day and group. \*\* Superscript mean significant differences ( $p < 0.001$ ) between *Canton-S* 0% and *Canton-S* 2% for a given day and group.

### ...but does not affect developmental viability in either strain



Effect of MFGM consumption on progeny viability.

### MFGM consumption significantly affects dry weight and fat content...



Effect of MFGM consumption on dry weight. <sup>A,B</sup> superscripts mean significant differences between *W<sup>1118</sup>* males and females. <sup>C,D</sup> superscript mean significant differences between *Canton-S* males and females. a, b mean significant differences between 0% and 2% groups of the same strain. ( $p < 0.0001$ )

There are no differences on the FC between different strains and between males and females. The FC of *W<sup>1118</sup>* 2% and *Canton-S* 2% males and females is higher than in the *W<sup>1118</sup>* 0% and *Canton-S* 0% males and females.

The DW is higher in *Canton-S* than in *W<sup>1118</sup>*, and higher in females than in males. The DW of *W<sup>1118</sup>* 2% males and females is higher than in the *W<sup>1118</sup>* 0% males and females. There are no differences on the *Canton-S* groups.

### ...and alters the progeny lipid profile.

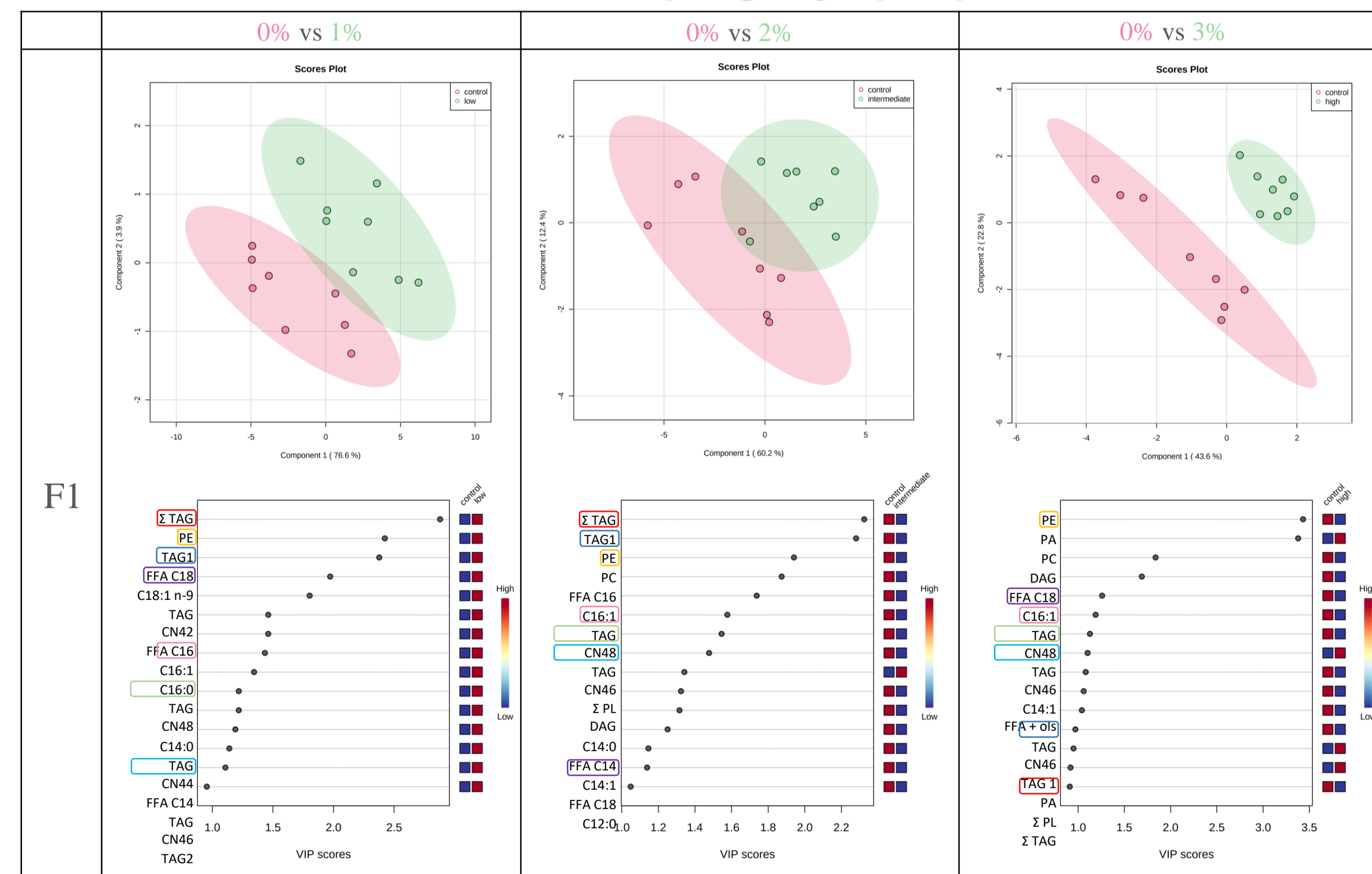


Figure 9. PLS-DA scores and variable importance in projection (VIP) for lipid features in first generation. Points in red represent the control values, green points represent the analyzed lipid profile of flies supplemented with 1-3%. Ellipses surrounding the points represent the 95% confidence interval

## CONCLUSIONS

- Supplementing the diet of *Canton-S* and *W<sup>1118</sup>* flies with 2% MFGM concentrate:
  - increases the TOTAL NUMBER of eggs laid, pupae and adults hatched.
  - increases the DAILY NUMBER of eggs laid, pupae and adults hatched in most of the days analyzed.
  - increases the egg-to-pupa viability and egg-to-adult viability of both strains.
- A diet enriched with 2% MFGM concentrate increases the dry weight and the fat content in the *W<sup>1118</sup>* and *Canton-S* *Drosophila* strains.
- A diet containing 1%, 2% and 3% MFGM produces alterations in different lipid features of *Drosophila*. TAG, PE, FFA C18, C16:1, TAG CN46 and CN48 levels are altered in all diets.

## REFERENCES

- Löfgren, Lars, et al. "The BUMÉ method: A novel automated chloroform-free 96-well total lipid extraction method for blood plasma [S]." *Journal of lipid research* 53.8 (2012): 1690-1700.
- Castro-Gómez, Pilar, et al. "Relevance of dietary glycerophospholipids and sphingolipids to human health. " *Prostaglandins, Leukotrienes and Essential Fatty Acids* 101 (2015): 41-51.

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