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The Use of *Drosophila melanogaster* as a Model Organism to Study the Effect of Bacterial Infection on Host Survival and Metabolism

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ABSTRACT

Infection-induced metabolic alterations is of great interest to many researchers. Here, we addressed the effect of *E.coli, S.enterica,* and *S.sonnei* infection on altering metabolic homeostasis of an infected host using the *Drosophila melanogaster* (DM) fruit fly model.

Our results revealed that both *E.coli* and *S. sonnei* were able to colonize the host gut and reduce its life span. Also, these orally infected *E.coli* and *S. sonnei* flies exhibited an alteration in the normal mobilization of lipids from the gut to the fat body, an increase in glucose and triglyceride levels, and a down-regulate in the expression of different peptide hormones (*AstA, DH31, and Tk*) known to regulate metabolic homeostasis in flies. On the contrary, *S.enterica* was unable to colonize the intestine of host; therefore, the metabolic status of *S.enterica* infected flies was unaltered.

INTRODUCTION

Large body of evidence have shown that an individual's array of commensal and pathogenic microbes contribute to chronic metabolic diseases such as obesity and diabetes. Therefore understanding different facets of host-pathogen cross-talk is imperative for defining the molecular bases of such metabolic disorders.

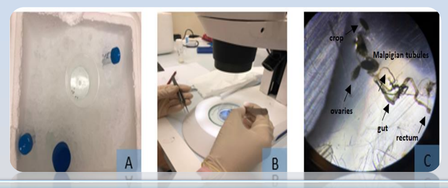
The huge similarity between a fruit fly and a mammalian intestine, along with the simplicity of a fly's signaling system as compared to that of mammals, and to its readily available genetic tools, make it a model organism of choice.

Here, we show an effect of *S.sonnei, S.enterica* and *E. coli* intestinal pathogenic infections on altering the metabolic status of an infected host.

METHODOLOGY

1. *Drosophila melanogaster* rearing and maintenance
2. Bacterial culture and *Drosophila melanogaster* infection

3. Survival assay and colonization of the fly gut
4. Organ dissection and fluorescence microscopy



5. Glucose and Triglyceride nutritional assays
6. Metabolic peptide hormone gene expression
   - -Total nucleic acid extraction
   - -DNA removal and RNA extraction
   - -Reverse transcriptase and cDNA synthesis
   - -RT-qPCR

RESULTS

Fig1 Life span of infected *Drosophila melanogaster* flies

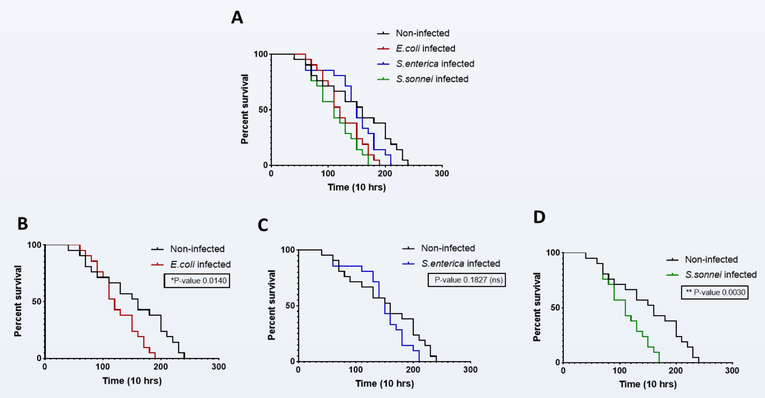


Fig2 Gut colonization of enteric pathogens in infected flies

Fig3 Lipid depletion from the fat body of *E. coli* and *S. sonnei* infected flies

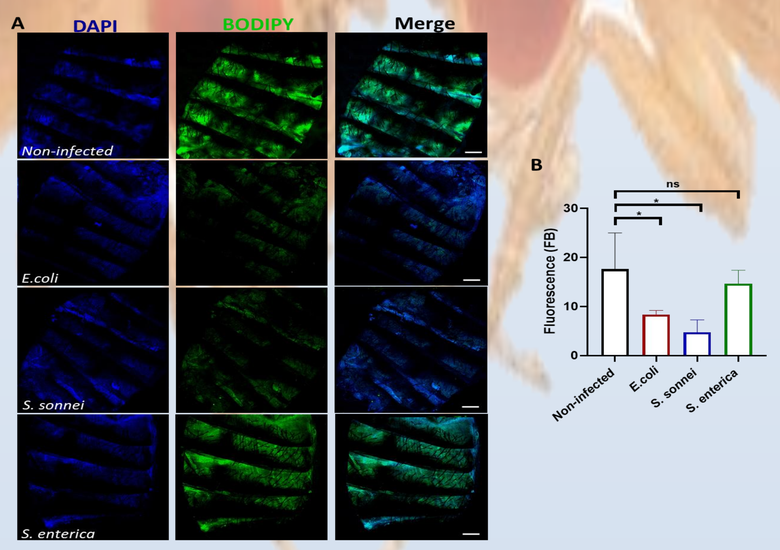


Fig4 Irregular lipid accumulation in the gut of *E. coli* and S.sonnei infected flies

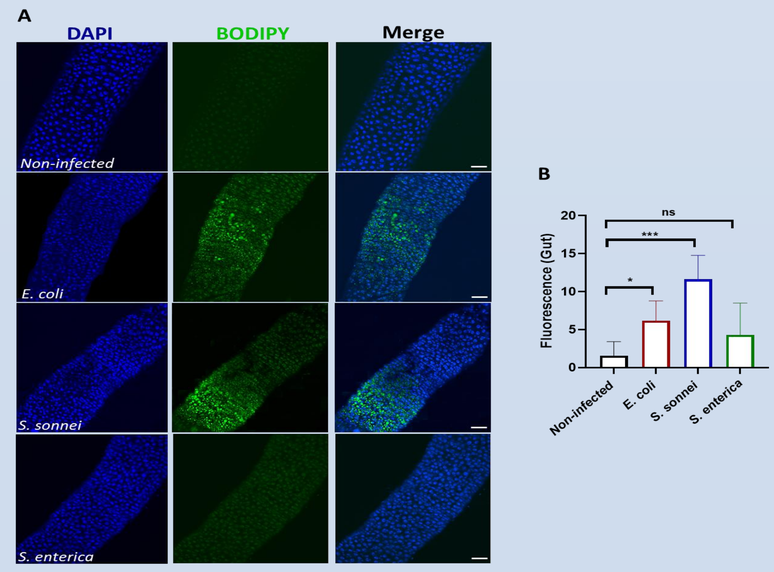


Fig5 Elevated glucose and triglyceride levels in *E. coli* and *S.sonnei* infected flies

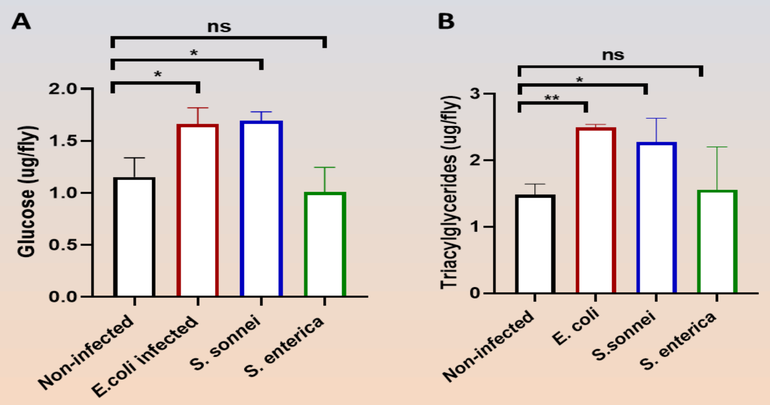
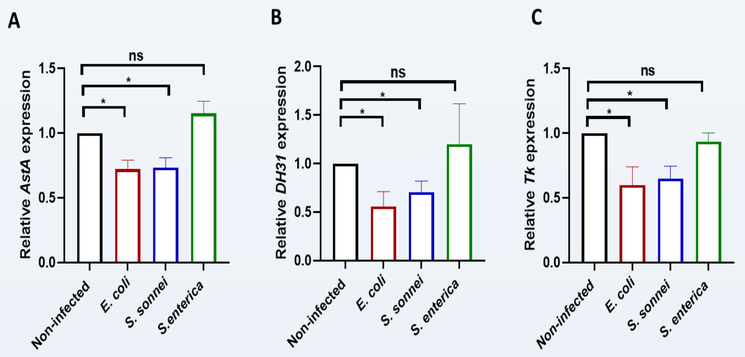


Fig6 Reduction in metabolic peptide hormone expression in *E. coli* and *S.sonnei* infected flies



CONCLUSIONS

- Infection with *E.coli* and *S.sonnei* (two gastrointestinal tract disease causing agents)disrupt many metabolic parameters in a host including normal lipid distribution and storage, and systemic glucose and triglyceride levels.
- This metabolic alteration in *E.coli* and *S.sonnei* infected flies is thought to happen through a differential down-regulation in the production and/or secretion of *Tk, AstA,* and *DH31* metabolic peptide hormones.
- Our findings serve as a foundation for future studies to develop profound implications that modulate the pathogenesis of gastrointestinal tract diseases, and open up for promising therapeutic approaches for infection-induced metabolic alterations.

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