

Mourning Doves, *Zenaida macroura*, are resistant to metabolic effects of a mammalian diabetogenic refined-carbohydrate diet.



Anthony J. Basile^a, William Clark^a, Xiaojian Shi^b, Haiwei Gu^b, Pierre Deviche^a, Karen L. Sweazea^{a,b}
^aSchool of Life Sciences, Arizona State University, Tempe, AZ, USA; ^bCollege of Health Solutions, Arizona State University, Phoenix, AZ, USA

INTRODUCTION

- Mammals develop pathologies in response to chronic hyperglycemia or consumption of a refined carbohydrate diet
- Plasma glucose in birds is normally 1.5-2 times higher than mammals of similar body mass, yet high glycemia in birds is not associated with pathologies.
- Whether granivorous birds such as the Mourning Dove would respond negatively to a refined carbohydrate diet is undetermined.

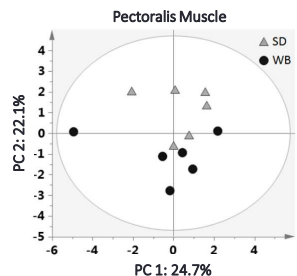
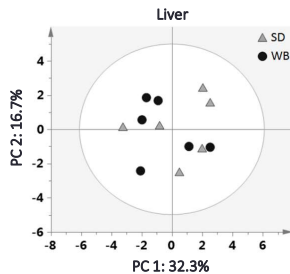
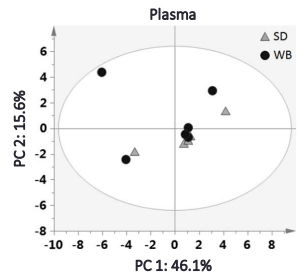
HYPOTHESIS

Mourning Doves fed a refined carbohydrate diet for four weeks will develop diabetes-like pathologies including hyperglycemia and altered metabolic profiles when compared to birds fed nutritionally balanced seed diet.

METHODS

- Adult male mourning doves (110-130 g body mass) were caught on the Arizona State University, Tempe campus in a walk in funnel-style trap.
- After a two week long adaptation period, birds were fed either seeds (n=6; SD) or a refined white bread (n=6, WB) diet with ad libitum access to water for 4 weeks.
- After euthanasia (200 mg sodium pentobarbital/kg i.p.), blood and tissues were collected for metabolomics analyses (liquid chromatography-mass spectrometry) and additional metabolite assays on plasma, liver, and pectoralis muscle samples.

RESULTS



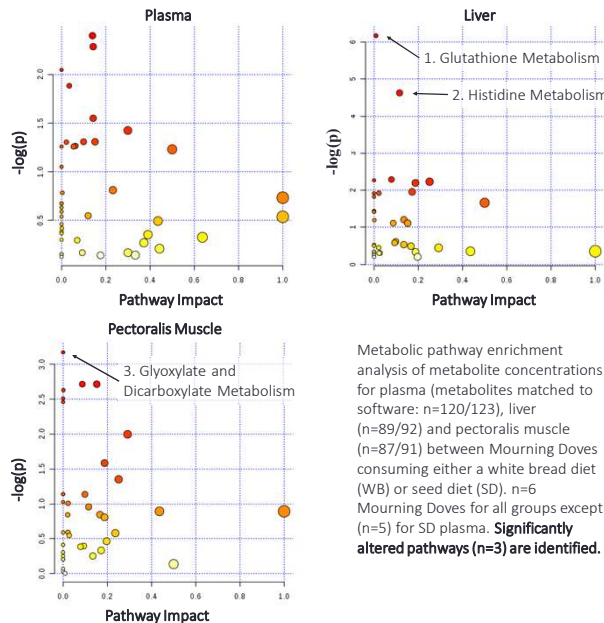
PCA plots produced from the metabolite concentration data for each Mourning Dove consuming either a white bread diet (WB) or seed diet (SD). n=6 except for plasma (n=5) for SD plasma. **The results reveal no separation between WB and SD birds.**

RESULTS

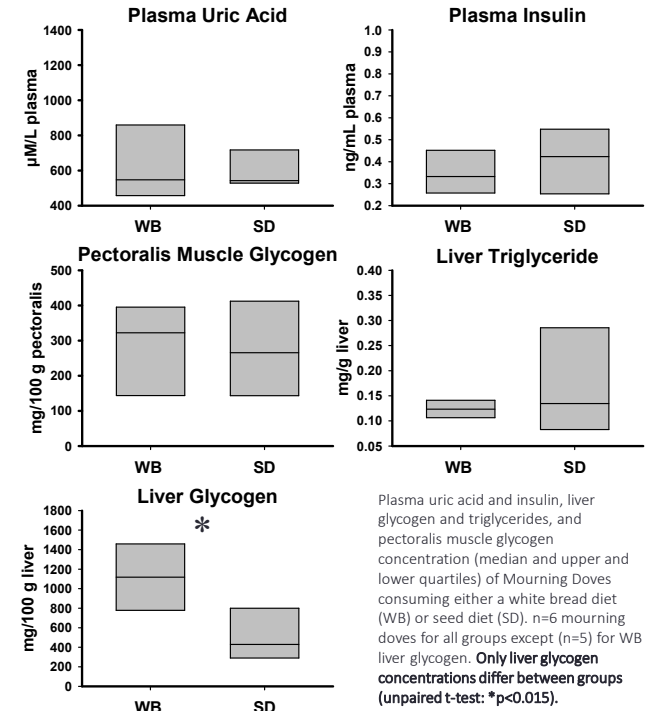
Significantly different metabolite concentrations between Mourning Doves fed a white bread diet or seed diet

| Plasma | FC | p-value | SD % CV | WB % CV |
|------------------------------|------|---------|---------|---------|
| indole-3 acetic acid | 1.27 | 0.0071 | 13.67 | 7.85 |
| <i>m-Coumaric acid</i> | 0.66 | 0.0144 | 20.15 | 18.48 |
| normetanephrine | 1.41 | 0.0144 | 17.88 | 18.63 |
| <i>pentadecanoic acid</i> | 1.75 | 0.0175 | 36.87 | 27.81 |
| epinephrine | 1.32 | 0.0196 | 5.51 | 17.90 |
| p-Coumaric acid | 0.82 | 0.0249 | 12.11 | 7.15 |
| stearic acid | 1.24 | 0.0338 | 16.51 | 12.19 |
| amiloride | 1.61 | 0.0350 | 24.44 | 32.07 |
| oxaloacetic acid | 0.77 | 0.0421 | 12.48 | 25.87 |
| Liver | FC | p-value | SD % CV | WB % CV |
| pregnenolone sulfate | 0.56 | 0.0023 | 20.43 | 28.35 |
| pyroglutamic acid* | 1.68 | 0.0069 | 37.69 | 18.55 |
| ornithine* | 1.62 | 0.0086 | 21.06 | 23.59 |
| glucose-1-phosphate (G1P) | 1.64 | 0.0137 | 29.24 | 25.55 |
| leucic acid | 1.36 | 0.0226 | 21.79 | 17.68 |
| 4-methyl-2-oxopentanoic acid | 0.59 | 0.0380 | 35.26 | 31.57 |
| methylhistamine* | 0.23 | 0.0459 | 70.54 | 133.41 |
| Pectoralis Muscle | FC | p-value | SD % CV | WB % CV |
| 2-aminoisobutyric acid | 0.26 | 0.0021 | 27.19 | 132.05 |
| <i>pentadecanoic acid</i> | 1.82 | 0.0063 | 34.99 | 24.86 |
| <i>m-coumaric acid</i> | 0.70 | 0.0316 | 24.21 | 23.40 |
| adenosine | 0.63 | 0.0352 | 30.29 | 31.61 |
| leucine | 0.72 | 0.0375 | 19.32 | 30.03 |
| norleucine | 0.72 | 0.0375 | 19.32 | 30.03 |

n=6 for all groups except (n=5) for SD plasma; fold change (FC; WB/SD), p-value from a student's t-test. Italicized metabolites are matched between plasma and tissue. *Indicates the metabolite is within a significantly altered pathway in Figure Two.



Metabolic pathway enrichment analysis of metabolite concentrations for plasma (metabolites matched to software: n=120/123), liver (n=89/92) and pectoralis muscle (n=87/91) between Mourning Doves consuming either a white bread diet (WB) or seed diet (SD). n=6 Mourning Doves for all groups except (n=5) for SD plasma. **Significantly altered pathways (n=3) are identified.**



Plasma uric acid and insulin, liver glycogen and triglycerides, and pectoralis muscle glycogen concentration (median and upper and lower quartiles) of Mourning Doves consuming either a white bread diet (WB) or seed diet (SD). n=6 mourning doves for all groups except (n=5) for WB liver glycogen. **Only liver glycogen concentrations differ between groups (unpaired t-test: *p<0.015).**

DISCUSSION

- The WB diet produced minimal changes in plasma, liver, and pectoralis muscle metabolite concentrations and metabolic pathways, but liver glycogen and G1P concentrations were significantly elevated in WB compared to SD doves.
- Surprisingly, WB did not elevate blood glucose levels (data not shown), which is in contrast to a study by Adekunle & Omoh 2014 that showed broiler chickens fed 50% bread waste meal for eight weeks had significantly decreased plasma glucose although the level remained within their physiological range.
- In conclusion, Mourning Doves fed a refined carbohydrate diet for four weeks may adjust their metabolic physiology to prevent mammalian-like complications.

FUNDING

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