

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



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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.

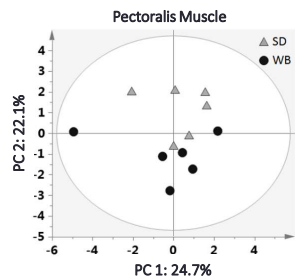
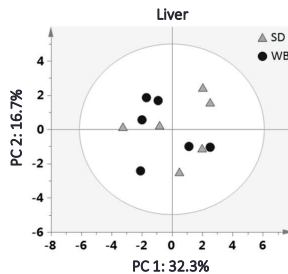
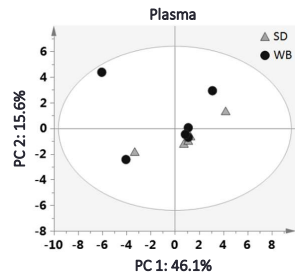
HYPOTHESIS

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



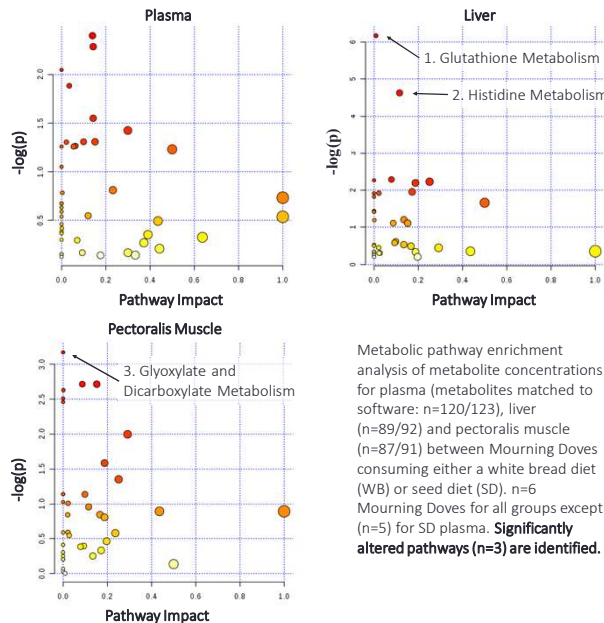
PCA plots produced from the metabolite concentration data for each Mourning Dove consuming either a white bread diet (WB) or seed diet (SD). n=6 except for plasma (n=5) for SD plasma. **The results reveal no separation between WB and SD birds.**

RESULTS

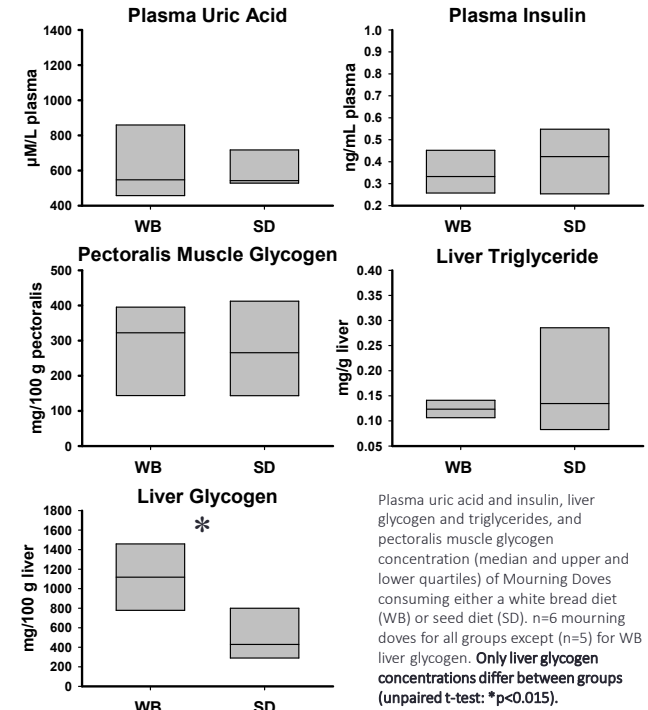
Significantly different metabolite concentrations between Mourning Doves fed a white bread diet or seed diet

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.

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