Metabolic effects of bittergourd fruit and bittergourd stems-leaves in obese/diabetic Göttingen minipigs.

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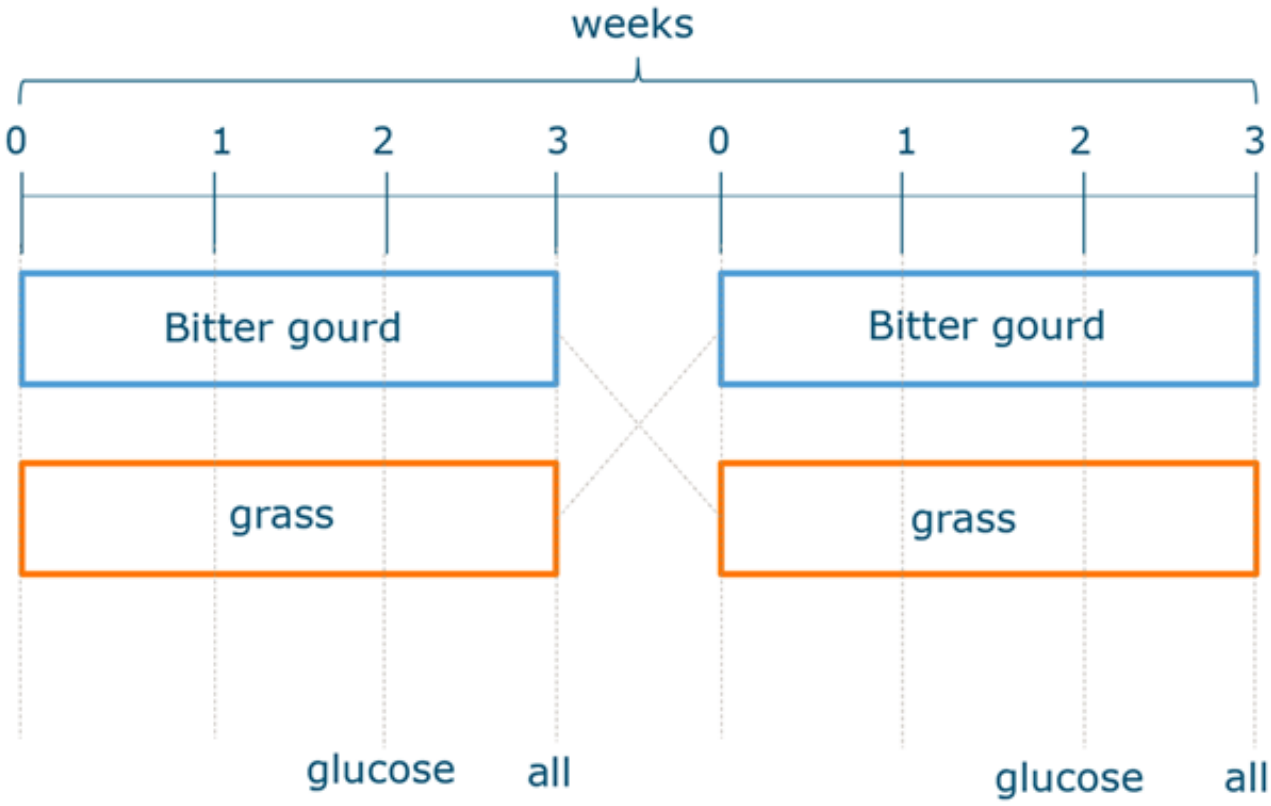
Experimental set-up for testing bioactivity of Bittergourd in minipigs

- Sixteen to twenty-one obese, streptozotocin-induced (pre)diabetic minipigs (70-90 kg body weight) were studied. One group of pigs was prediabetic (n=10 to n=11), the other group of pigs was diabetic (n=6 to n=10).
- 6-week trial per type of bittergourd: control for 3 weeks (grass) – bittergourd for 3 weeks in a cross-over design.
- Metformin was used as human-drug reference (known effect on glucose metabolism in liver, muscle and fat)
- Each day, 20 grams of dried powdered Bittergourd or grass was added to 500 grams of pig pellets which was fed in the afternoon (around 3-4 pm).
- Overnight fasting blood collection at the end of each 3-week time period.

Cross-over design. Half of the pigs received bittergourd first; the other half received grass first.



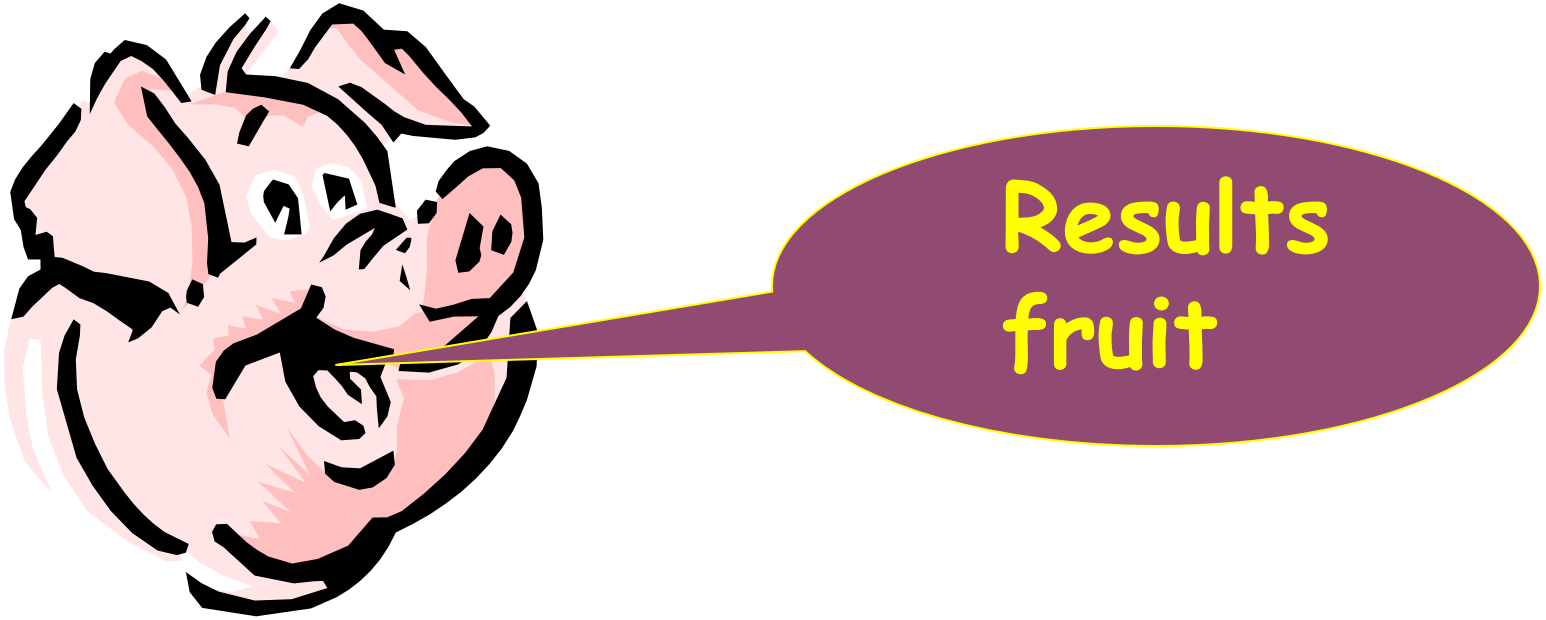
Blood samples at week 3

Experimental set-up for testing bioactivity of Bittergourd in minipigs

- Blood collection (droplet and 10 mL) at end of 3-week time periods.
- Analyses of blood and/or plasma glucose, ketones, triglycerides, total cholesterol, LDL-cholesterol, HDL cholesterol, fructosamine, protein and insulin.

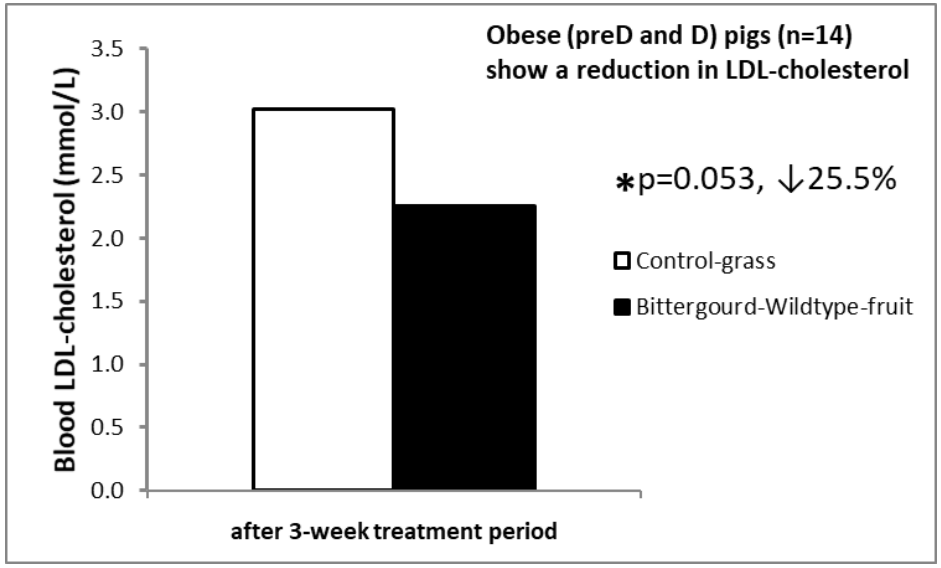
From Febr 2019 till May 2020, 10 trials have been conducted in obese adult minipigs

- Trial 1: Wild-type fruit
- Trial 2: HMT fruit
- Trial 3: Palee fruit
- Trial 4: Good-healthy (GH) fruit
- Trial 5: Wild-type stems-leaves
- Trial 6: Bilai (fresh-farma) stems-leaves
- Trial 7: Bilai (fresh-farma) fruit
- Trial 8: Mix of trial 1,2,3,4,7
- Trial 9: Palee stems-leaves
- Trial 10: Metformin


Results
fruit

Trial 1 Wildtype fruit. Total and LDL Cholesterol

All obese pigs



LDL-cholesterol = "bad" atherogenic cholesterol

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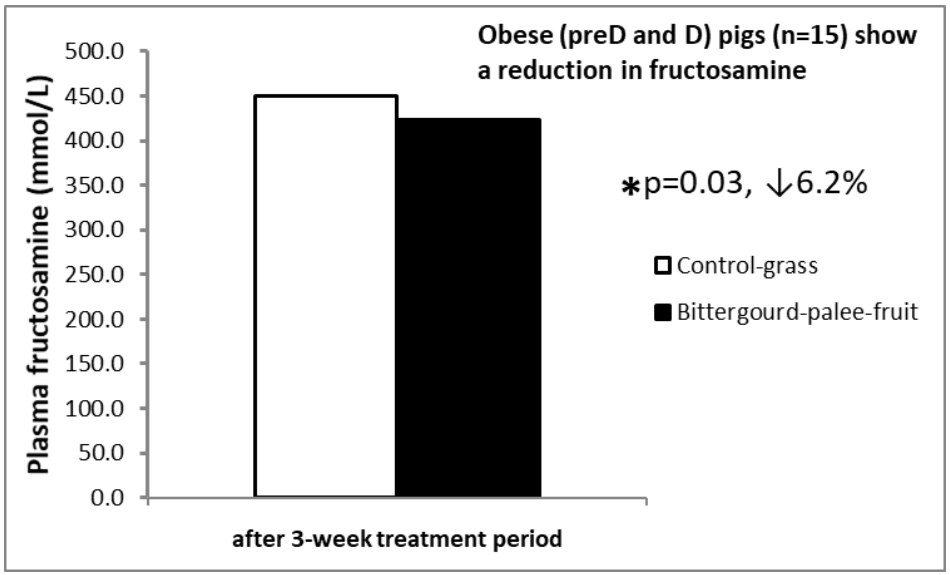
Trial 2 HMT fruit.

- No bioactivity detected in pigs

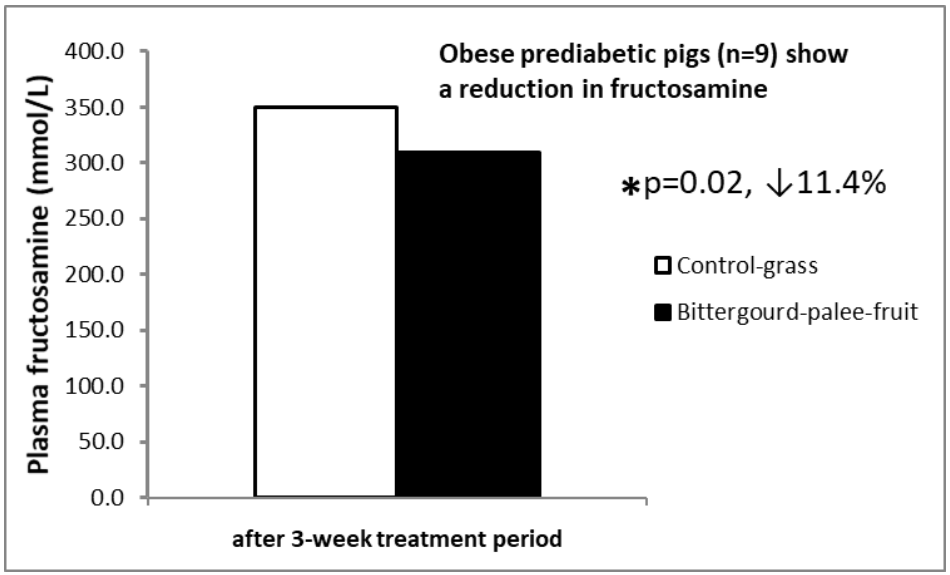
Trial 3 Palee fruit. Fructosamine

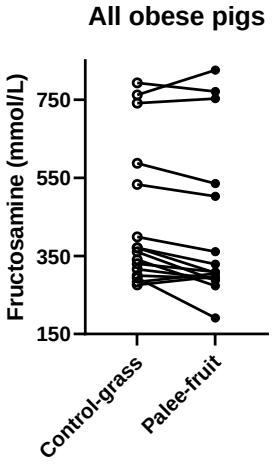
Fructosamine = reflection of daily blood glucose control

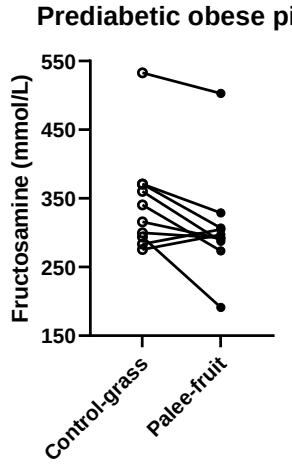
All obese pigs



Prediabetic obese pigs







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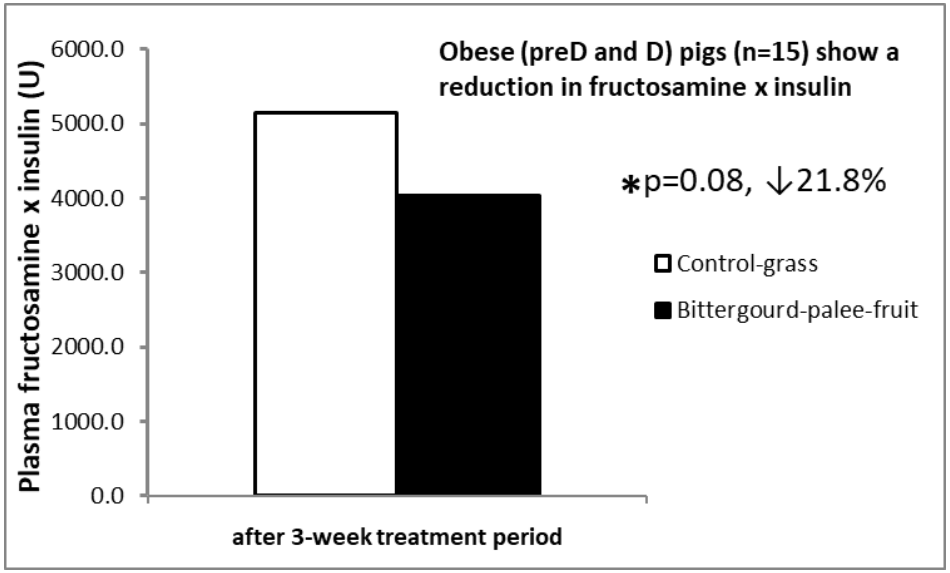
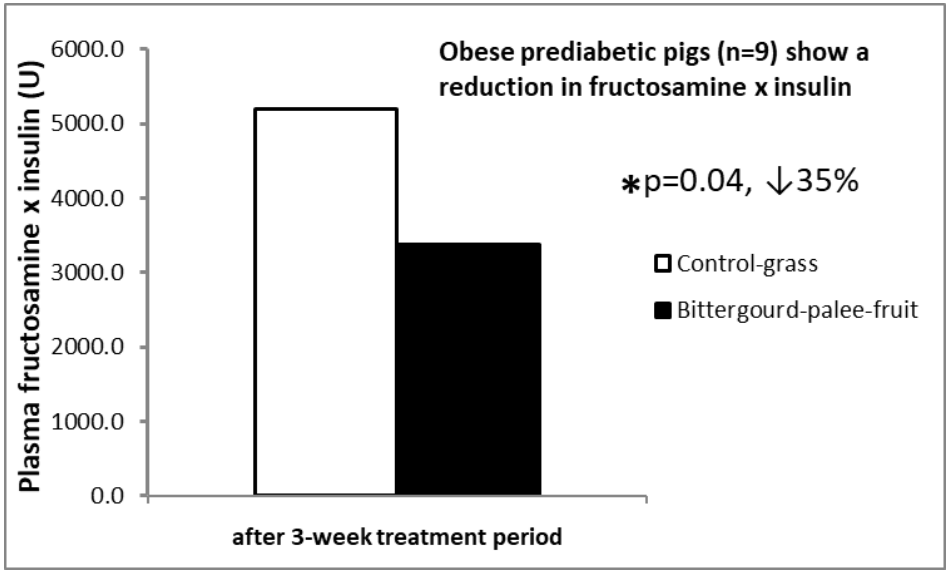
Trial 3 Palee fruit. Fructosamine x insulin

All obese pigs



Prediabetic obese pigs



Fructosamine x insulin = reflection of daily insulin resistance

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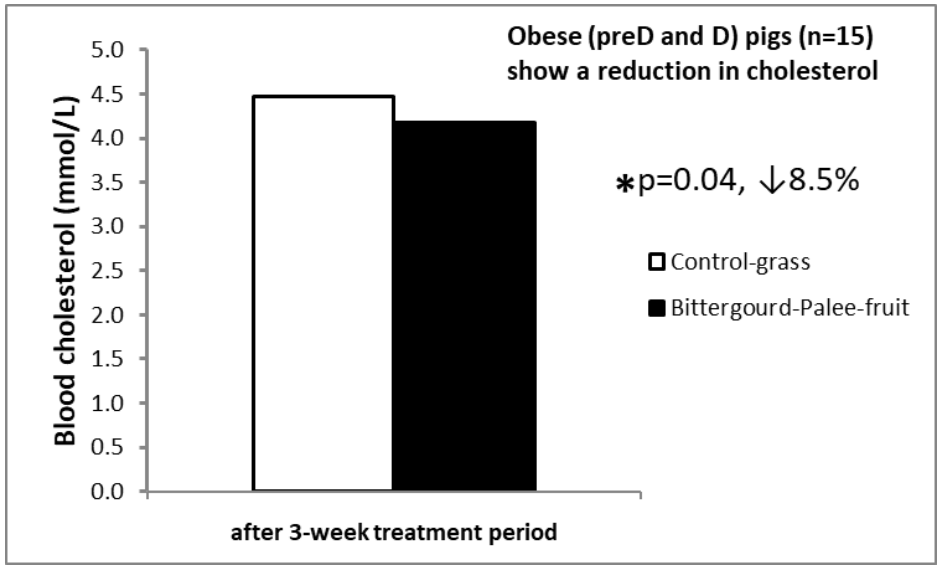
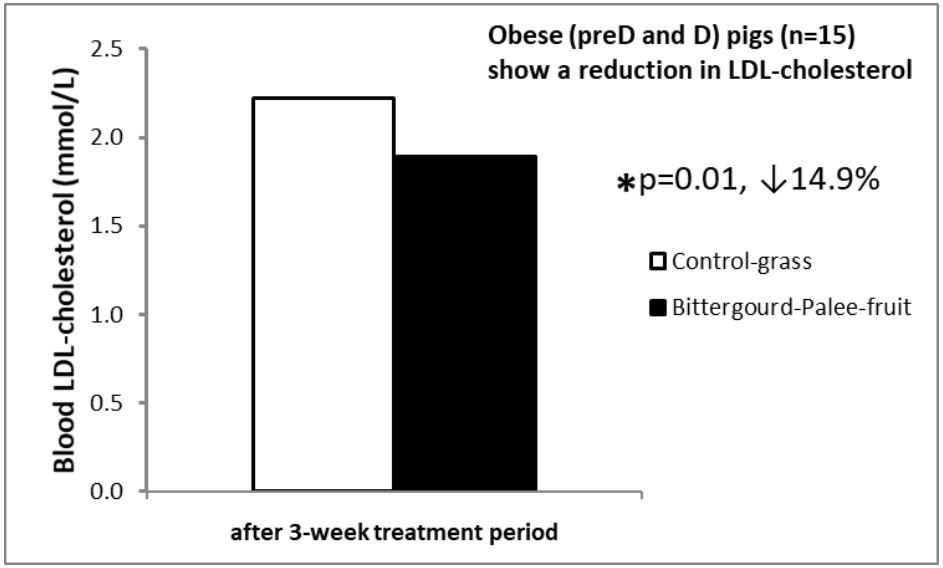
Trial 3 Palee fruit. Total and LDL Cholesterol

All obese pigs





LDL-cholesterol = "bad" atherogenic cholesterol

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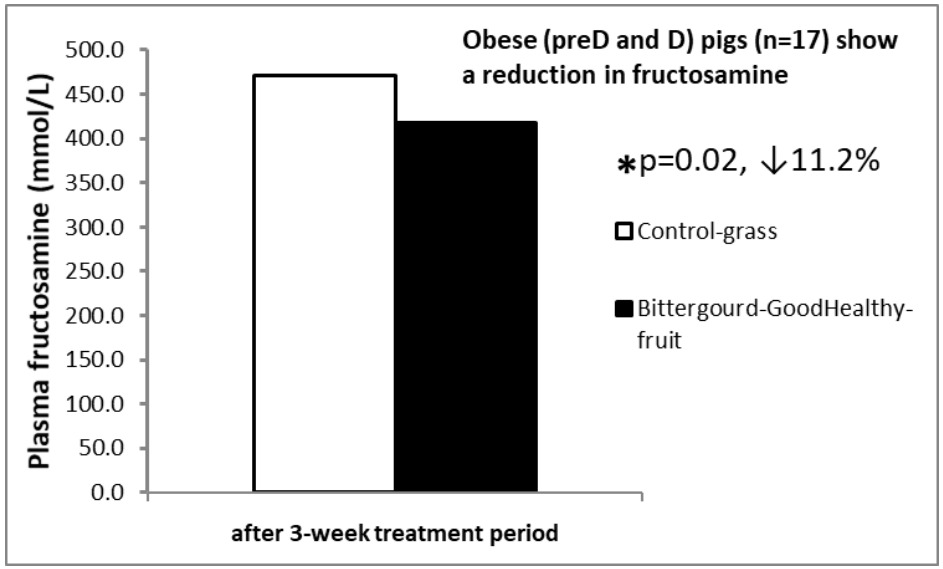
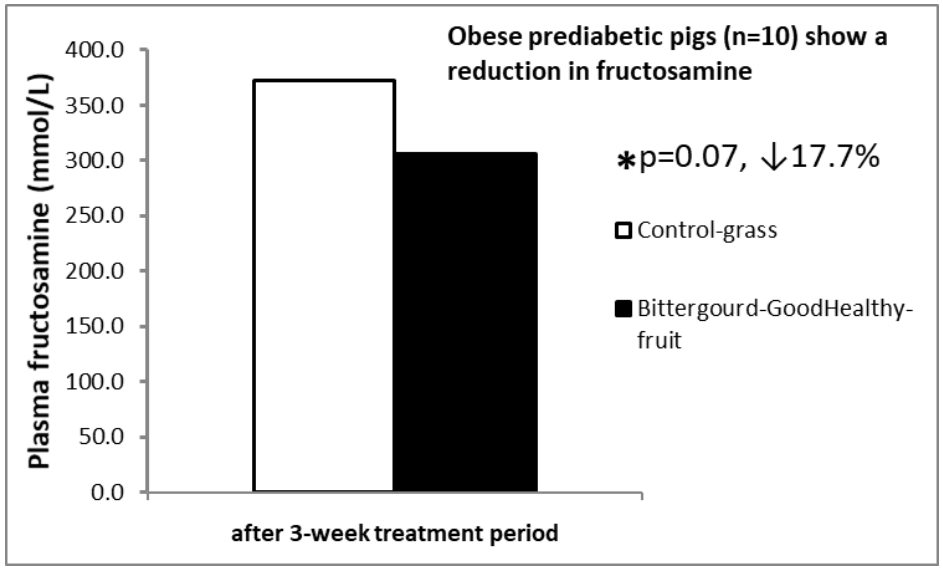
Trial 4 Good-healthy fruit. Fructosamine

All obese pigs



Prediabetic obese pigs



Fructosamine = reflection of daily blood glucose control

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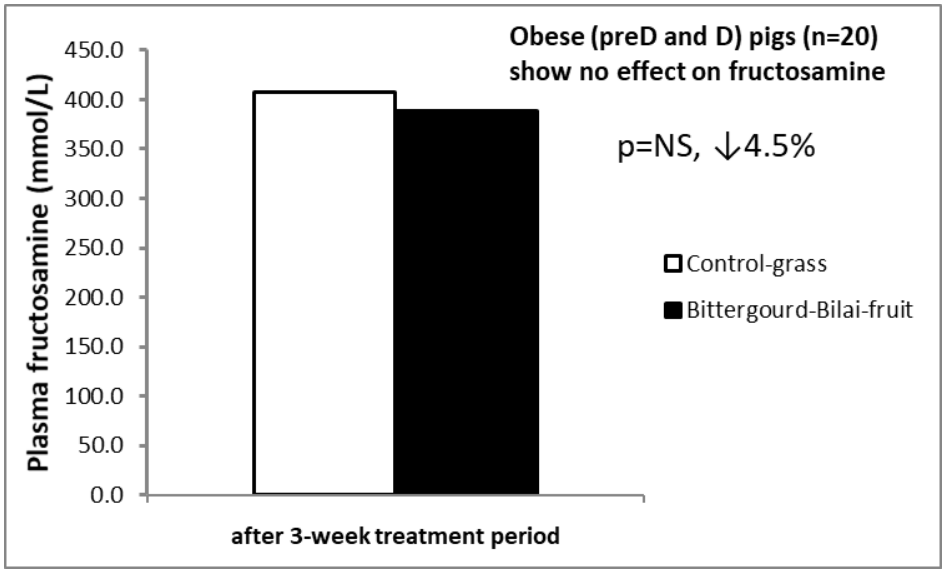
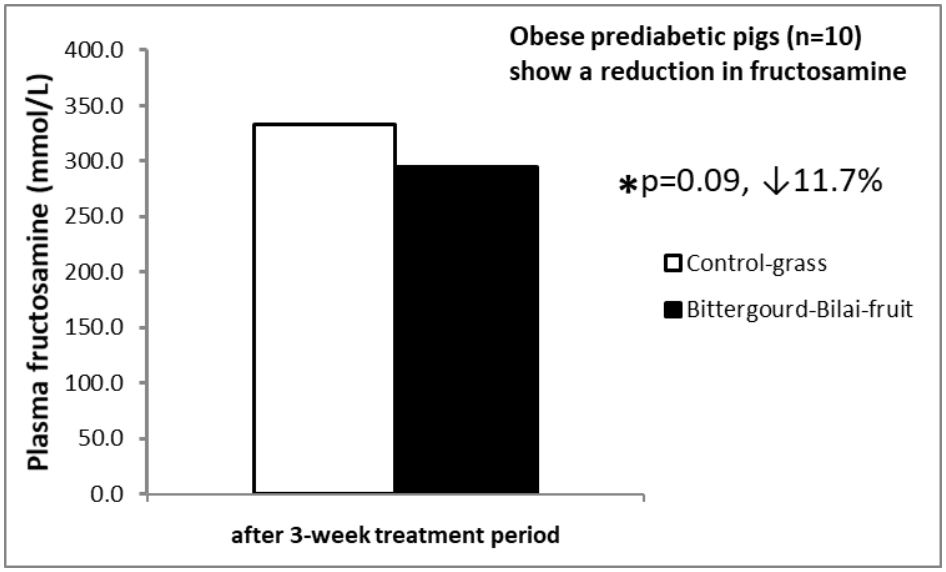
Trial 7 Bilai (fresh-farma) fruit. Fructosamine

All obese pigs



Prediabetic obese pigs



Fructosamine = reflection of daily blood glucose control

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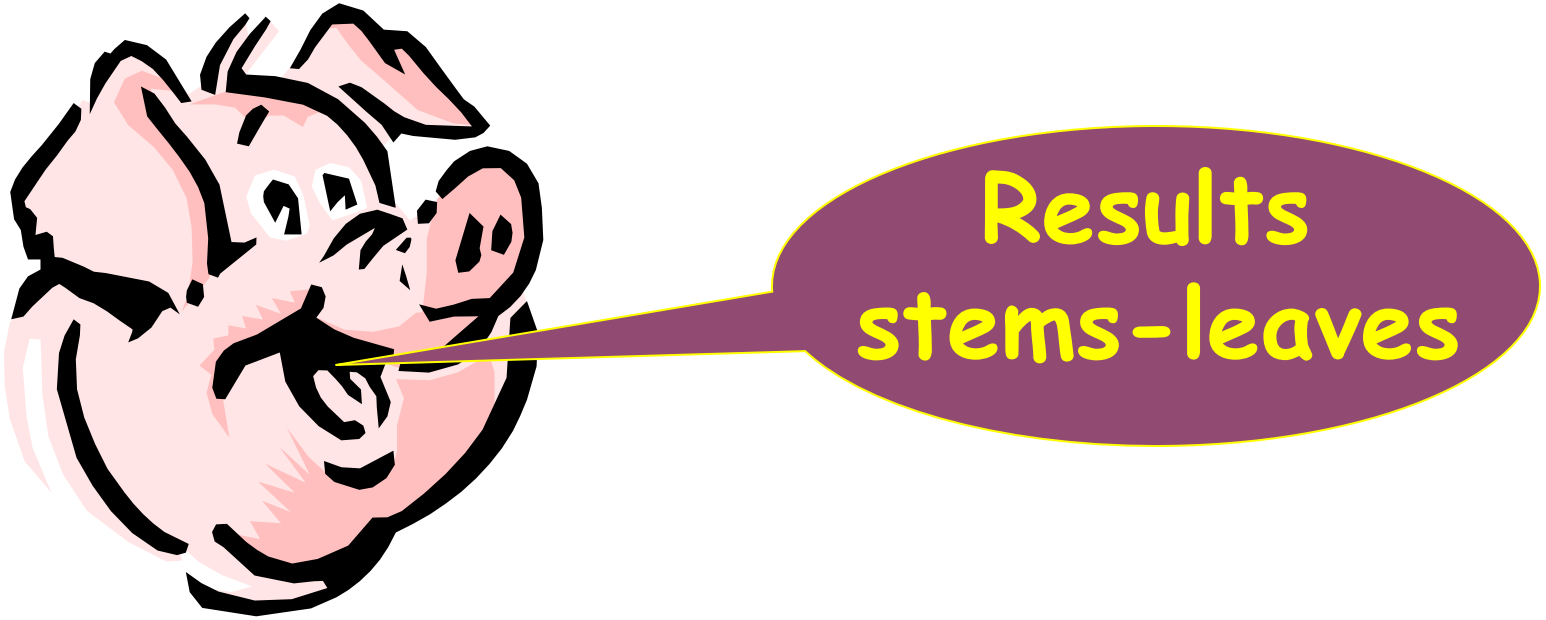
Trial 8 mix of trial 1,2,3,4 and 7 fruit.

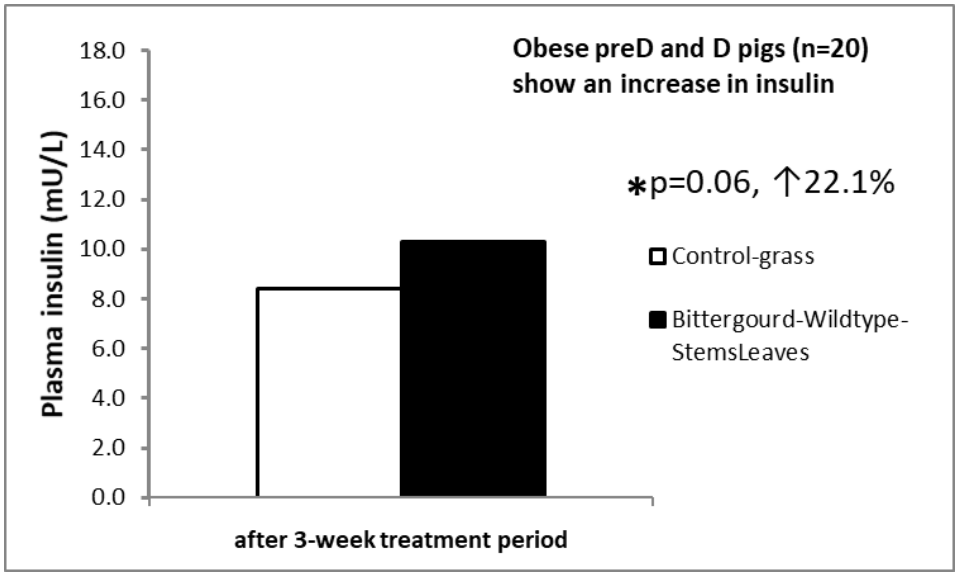
- No bioactivity detected in pigs.

Fruit mix was not compared to grass but was compared to no addition.

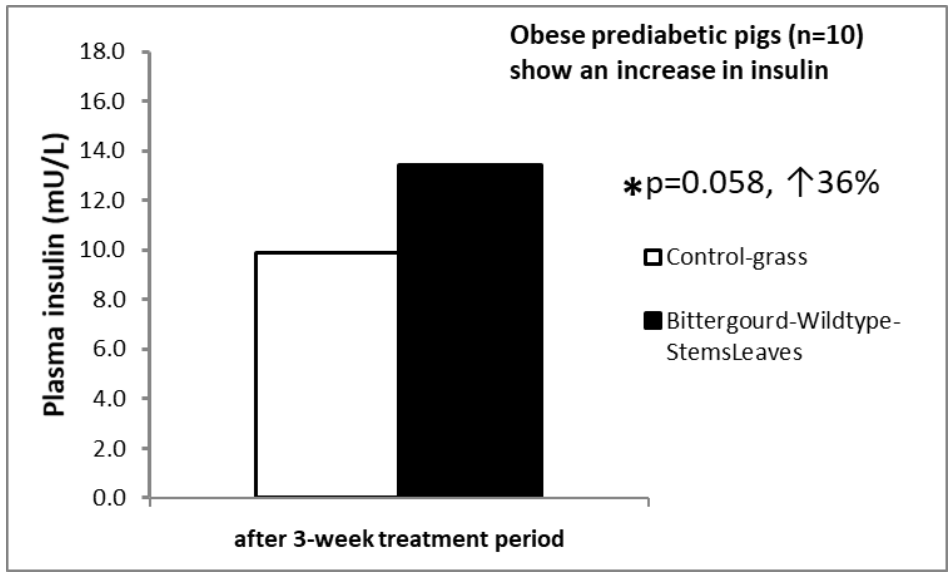

Results
stems-leaves

Trial 5 Wildtype stems-leaves. Fasting insulin.

All obese pigs



Prediabetic obese pigs



Insulin = controls metabolism

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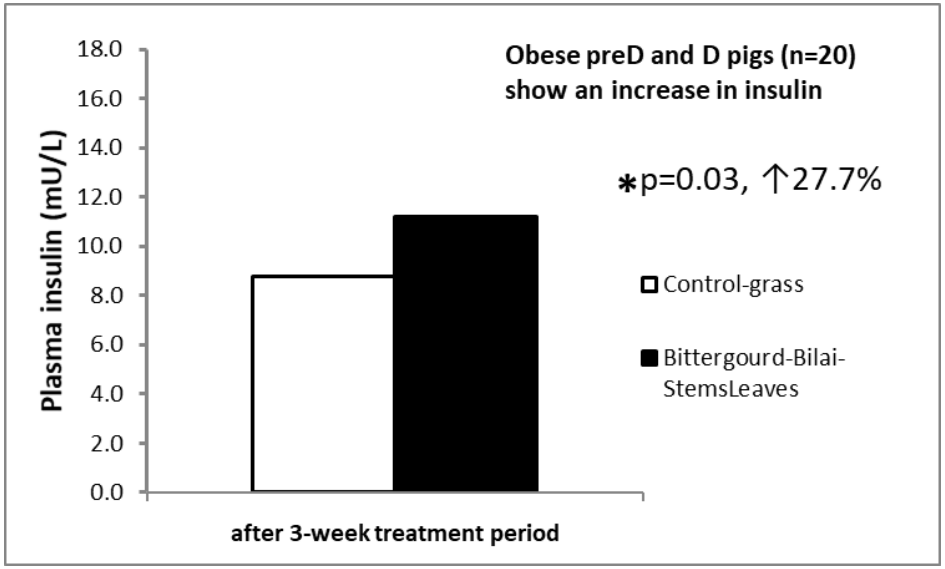
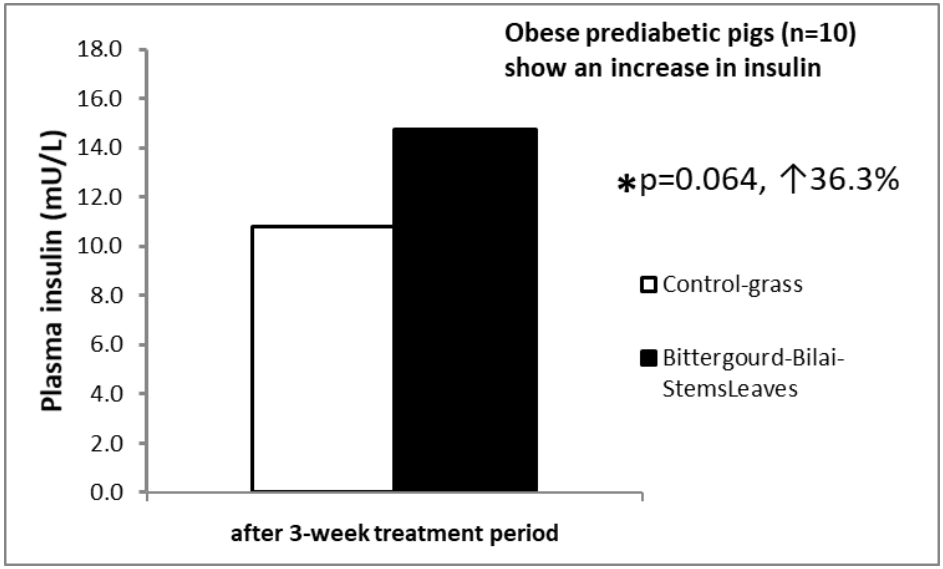
Trial 6 Bilai (fresh farma) stems-leaves. Fasting insulin

All obese pigs



Prediabetic obese pigs



Insulin = controls metabolism

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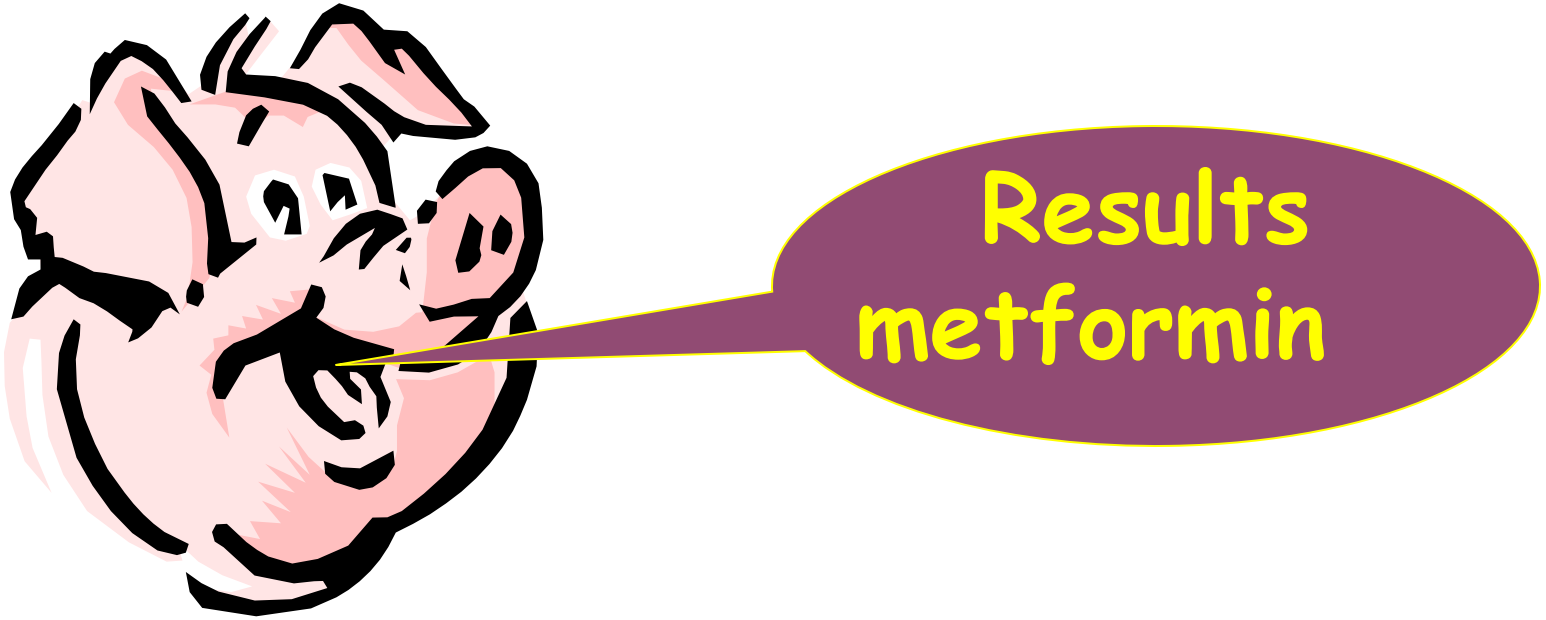
Trial 9 Palee stems-leaves.

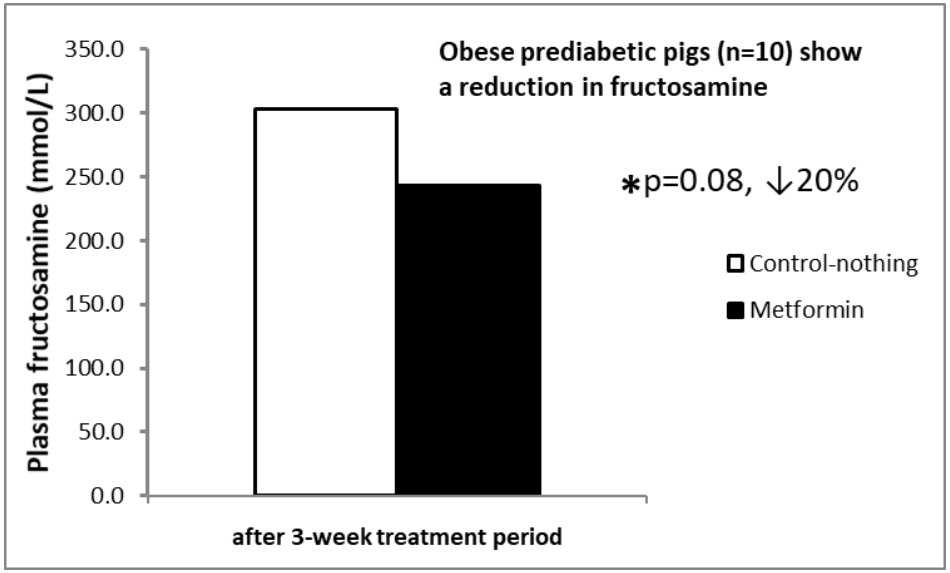
- No bioactivity detected in pigs (insulin ↑ 9-22% but P=NS).

Palee stems-leaves was not compared to grass but was compared to no addition.

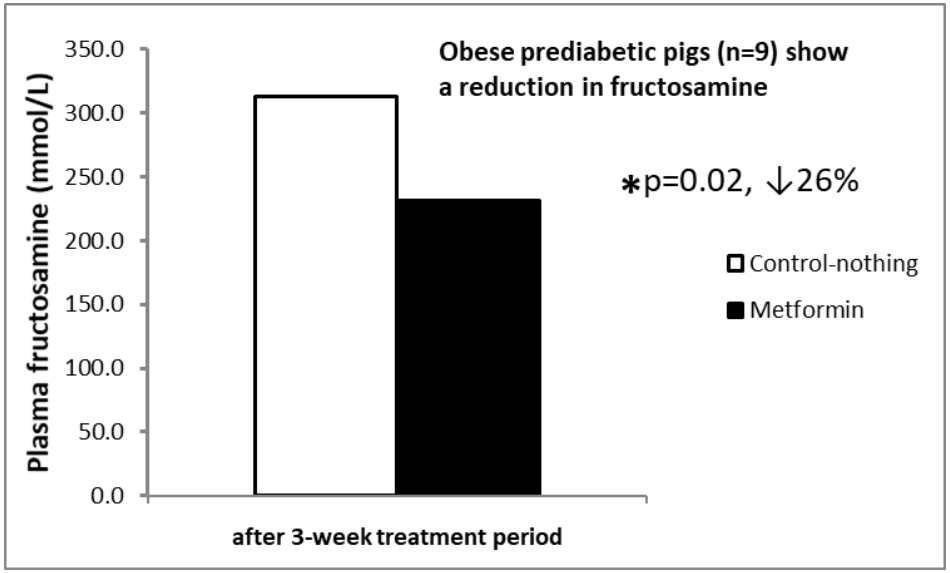

Results
metformin

Trial 10 Metformin. Fructosamine

Prediabetic obese pigs



Prediabetic obese pigs excluding one adverse responder



Fructosamine = reflection of daily blood glucose control

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Summary

- Palee and Good Healthy fruit reduce plasma fructosamine concentrations in obese prediabetic pigs (fructosamine is a reflection of average plasma glucose levels throughout the day).
- Palee fruit reduces insulin resistance in obese prediabetic pigs and reduces total cholesterol and LDL cholesterol in blood of obese (prediabetic and diabetic) pigs .

- Wildtype and Bilai stems-leaves increase fasting plasma insulin concentrations in obese prediabetic pigs.

Potential mode of action (also Choi et al)

- Bittergourd fruit may improve daily plasma glucose control by increasing renal urinary glucose excretion (Xuedanoside H), decrease carbohydrate digestion in the intestine (Karaviloside IX) and increase insulin sensitivity (fructosamine x insulin) in obese prediabetic subjects.
- Bittergourd fruit may reduce total cholesterol and LDL cholesterol in blood by (????) in obese prediabetic and diabetic subjects.

- Bittergourd stems-leaves may increase fasting plasma insulin concentrations by (????) in obese prediabetic pigs.