Tracking (and Hacking) My Glucose

2014 Quantified Self Europe Conference

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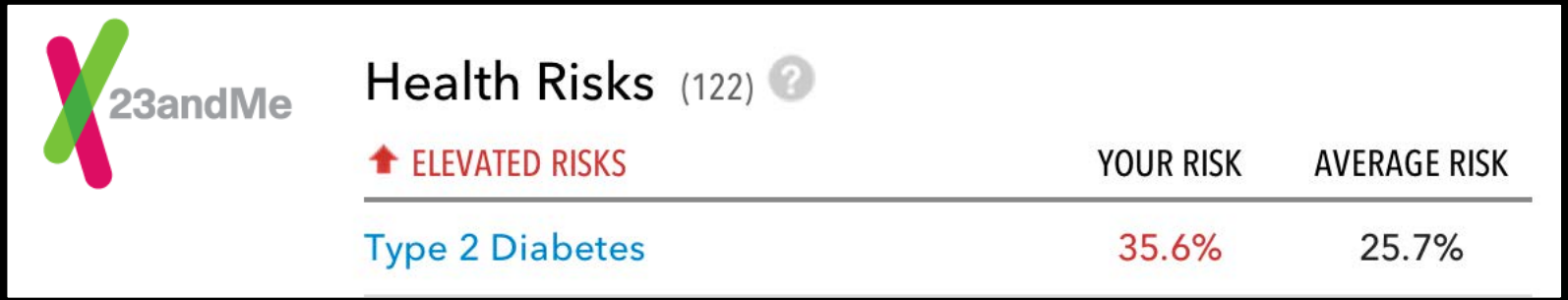
Fasting Plasma Glucose Guidelines

American Diabetes Association: 70 – 130(!) mg/dL (3.9-5.6 mmol/L)
Life Extension Foundation: 70 – 85 mg/dL (3.9-4.7mmol/dL)

Me: **85 mg/dL** (ok, but not *ideal*!)



Oxaloacetate

Open Access

Oxaloacetic Acid Supplementation as a Mimic of Calorie Restriction

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Abstract: The reduction in dietary intake leads to changes in metabolism and gene expression that increase lifespan, reduce the incidence of heart disease, kidney disease, Alzheimer's disease, type-2 diabetes and cancer. While all the molecular pathways which result in extended lifespan as a result of calorie restriction are not fully understood, some of these pathways that have resulted in lifespan expansion have been identified. Three molecular pathways activated by calorie restriction are also shown to be activated by supplementing the diet with the metabolite oxaloacetic acid. Animal studies supplementing oxaloacetic acid show an increase in lifespan and other substantial health benefits including mitochondrial DNA protection, and protection of retinal, neural and pancreatic tissues. Human studies indicate a substantial reduction in fasting glucose levels and improvement in insulin resistance. Supplementation with oxaloacetic acid may be a safer method to mimic calorie restriction than the use of traditional diabetes drugs.

INTRODUCTION

For over 75 years, scientists have known how to increase average and maximal lifespan; reduce dietary intake of calories by 25 to 40% over ad libitum baseline values while maintaining adequate nutrition. This reduction in dietary intake leads to changes in metabolism and gene expression that increase lifespan, and also been reported to reduce the incidence of heart disease, kidney disease, Alzheimer's disease, type-2 diabetes and cancer in animals [1-3]. While all the molecular pathways which result in extended lifespan as a result of calorie restriction are not fully understood, some of these pathways that have resulted in lifespan expansion have been identified. Three molecular pathways identified that increase lifespan as a result of calorie restriction are 1) Activation of the energy sensor AMP protein activated Kinase (AMPK) in the presence of a functional FOXO/Daf-16 transcription factor [4], 2) an increase in the Nicotinamide Adenine Dinucleotide (NAD+) to its reduced version (NADH) within the mitochondria [5], and 3) protection of mitochondrial DNA [6]. While these molecular longevity pathways are activated within dietary restriction, reduced calorie consumption is not necessarily required to achieve the life-extension benefits conferred by activation of these

citric acid cycle, and is found in every cell in the body. Fig. (1) shows a schematic diagram of the citric acid cycle and the position of oxaloacetate within the cycle.

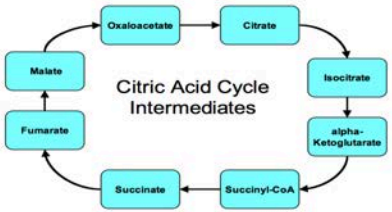

Fig. (1). Oxaloacetic acid, which in water becomes oxaloacetate, is part of the Citric Acid (Krebs) Cycle which is involved in energy production within the mitochondria. Oxaloacetic acid is a critical metabolic intermediate and is found within every mitochondrion.

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Oxaloacetate supplementation increases lifespan in *Caenorhabditis elegans* through an AMPK/FOXO-dependent pathway

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Summary Go to:

Reduced dietary intake increases lifespan in a wide variety of organisms. It also retards disease progression. We tested whether dietary supplementation of citric acid cycle metabolites could mimic this lifespan effect. We report that oxaloacetate supplementation increased lifespan in *Caenorhabditis elegans*. The increase was dependent on the transcription factor, FOXO/DAF-16, and the energy sensor, AMP-activated protein kinase, indicating involvement of a pathway that is also required for lifespan extension through dietary restriction. These results demonstrate that supplementation of the citric acid cycle metabolite, oxaloacetate, influences a longevity pathway, and suggest a tractable means of introducing the health-related benefits of dietary restriction.

Keywords: *Caenorhabditis* elegans, calorie restriction, lifespan

What did I do?

I took daily fasting glucose readings over a period of 7 months.

How did I do it?

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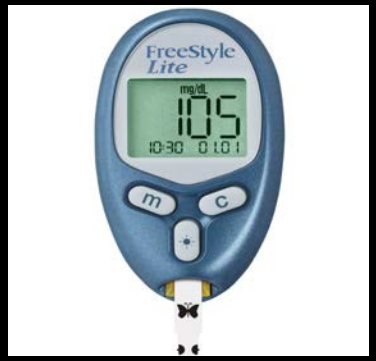

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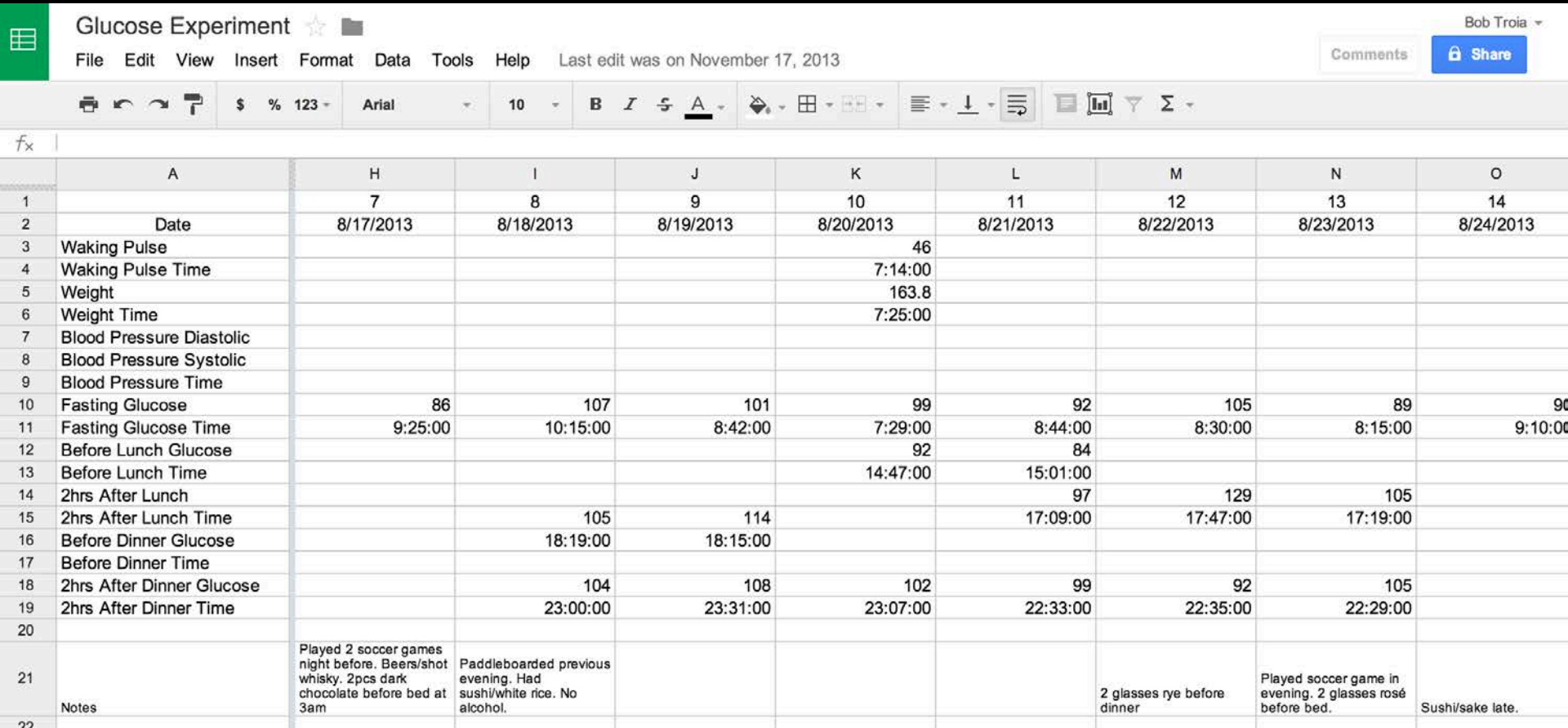
Glucose Experiment

File Edit View Insert Format Data Tools Help Last edit was on November 17, 2013

	A	H	I	J	K	L	M
1		7	8	9	10	11	12
2	Date	8/17/2013	8/18/2013	8/19/2013	8/20/2013	8/21/2013	8/22/2013
3	Waking Pulse				46		
4	Waking Pulse Time				7:14:00		
5	Weight				163.8		
6	Weight Time				7:25:00		
7	Blood Pressure Diastolic						
8	Blood Pressure Systolic						
9	Blood Pressure Time						
10	Fasting Glucose	86	107	101	99	92	105
11	Fasting Glucose Time	9:25:00	10:15:00	8:42:00	7:29:00	8:44:00	8:30:00
12	Before Lunch Glucose				92	84	
13	Before Lunch Time				14:47:00	15:01:00	
14	2hrs After Lunch					97	129
15	2hrs After Lunch Time		105	114		17:09:00	17:47:00
16	Before Dinner Glucose		18:19:00	18:15:00			
17	Before Dinner Time						
18	2hrs After Dinner Glucose		104	108	102	99	92
19	2hrs After Dinner Time		23:00:00	23:31:00	23:07:00	22:33:00	22:35:00
20							
21	Notes	Played 2 soccer games night before. Beers/shot whisky. 2pcs dark chocolate before bed at 3am	Paddleboarded previous evening. Had sushi/white rice. No alcohol.				2 glasses rye before dinner



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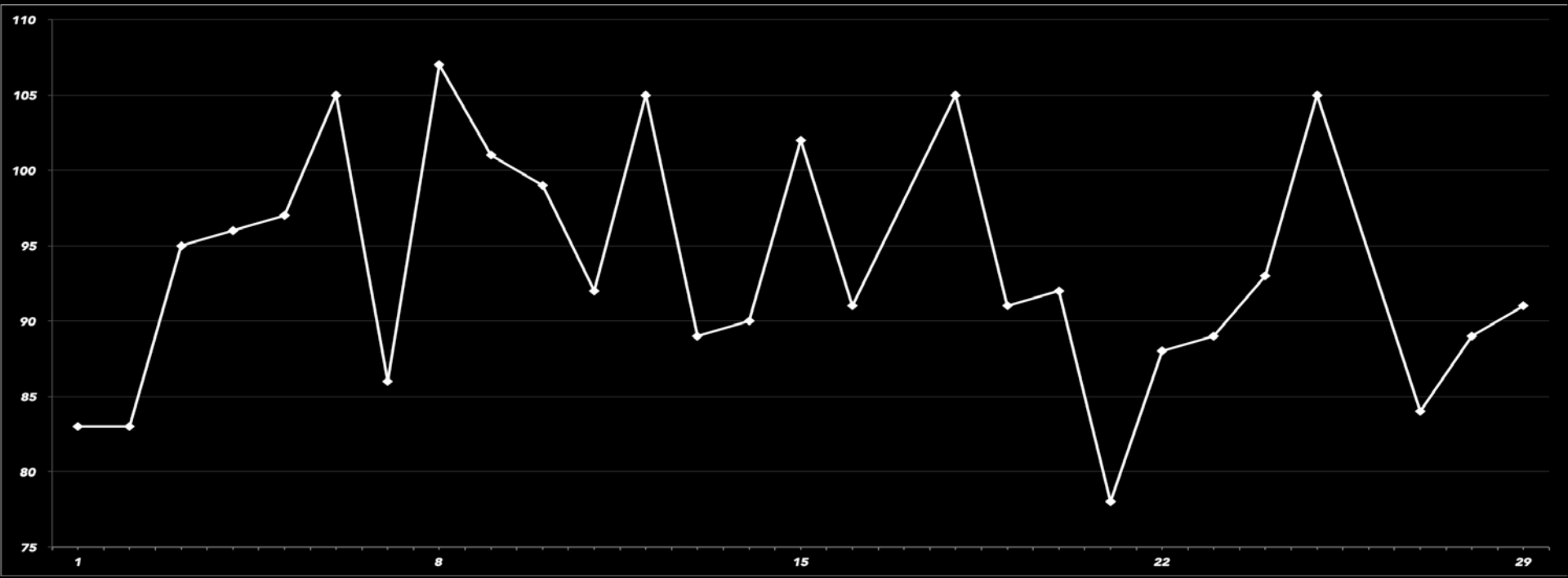
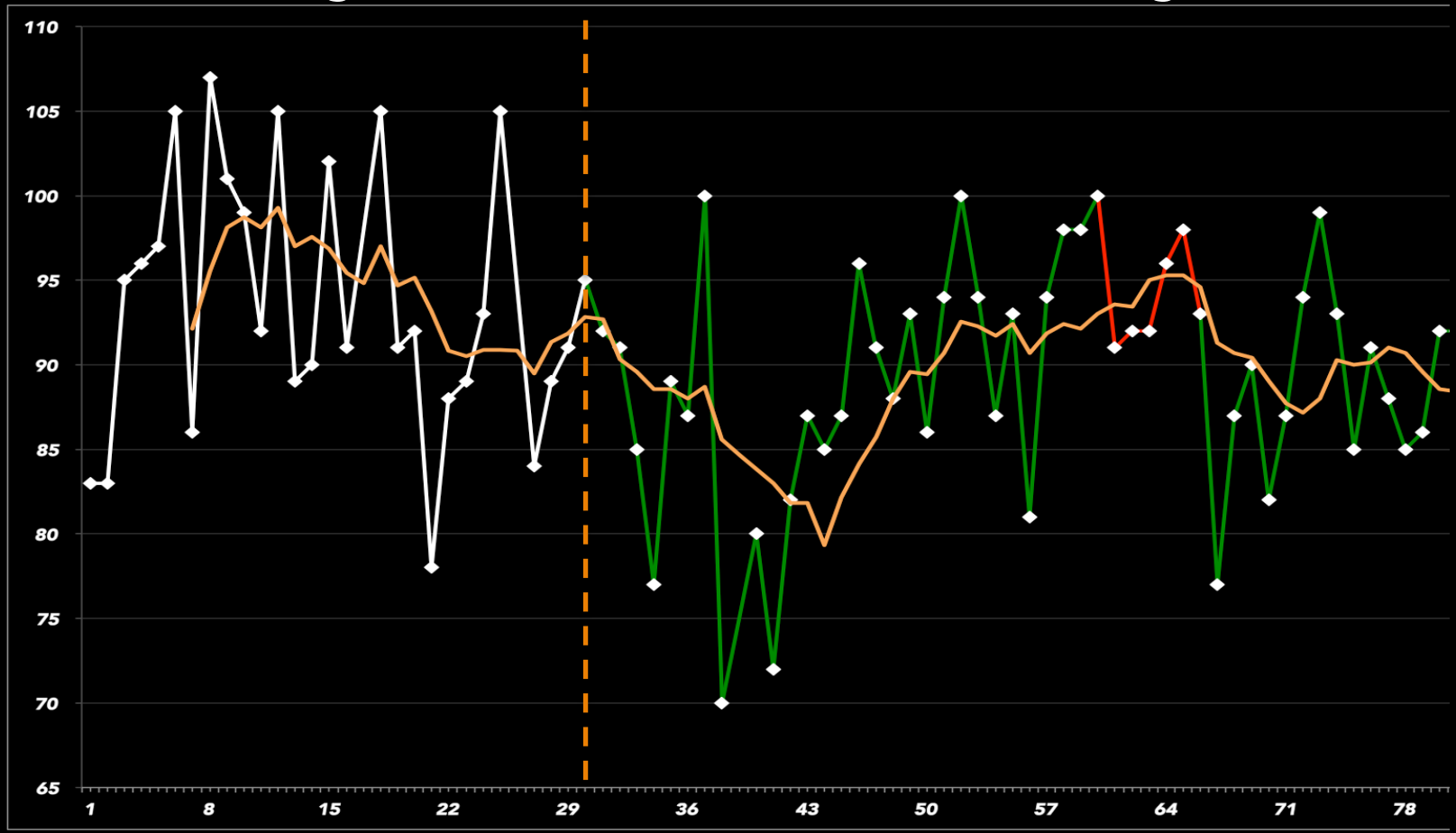
21	Notes	Played 2 soccer games night before. Beers/shot whisky. 2pcs dark chocolate before bed at 3am	Paddleboarded previous evening. Had sushi/white rice. No alcohol.				2 glasses rye before dinner	Played soccer game in evening. 2 glasses rosé before bed.	Sushi/sake late.

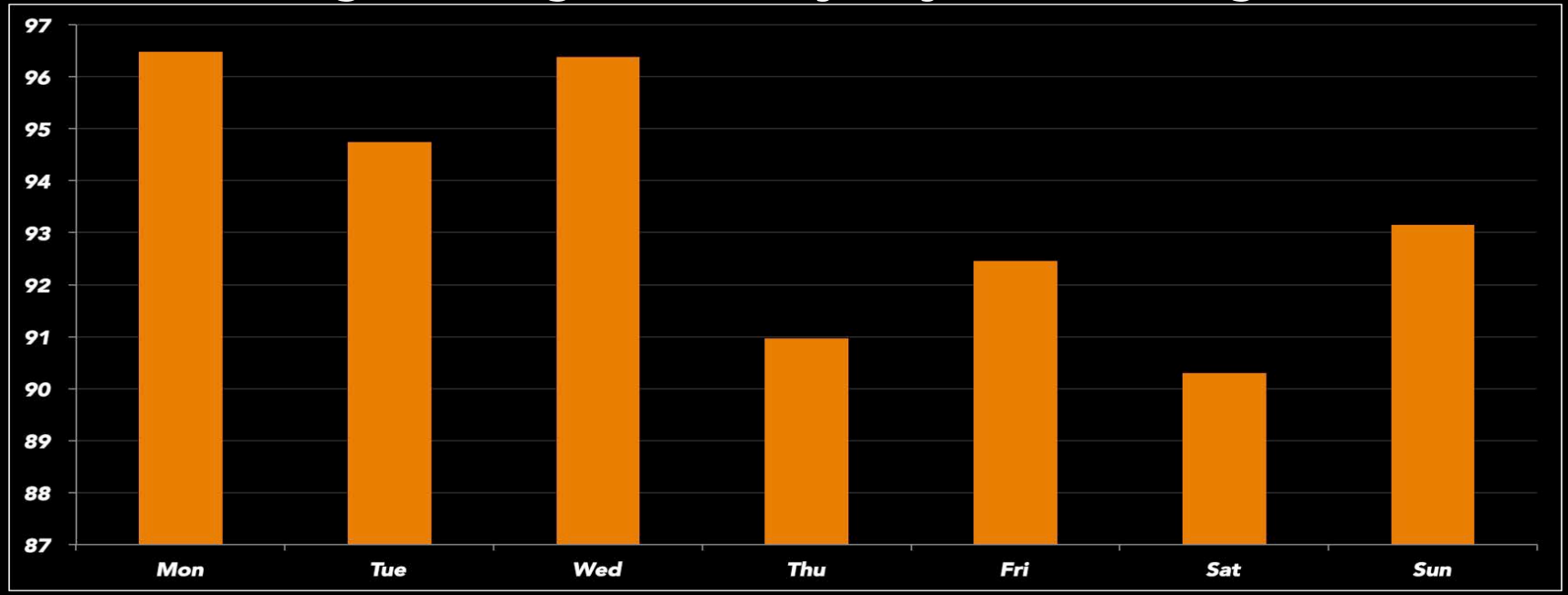
Baseline Fasting Glucose, First 30 Days (mg/dL)



Fasting Glucose Pre/Post Oxaloacetate (mg/dL)



Average Fasting Glucose by Day of Week (mg/dL)



There is a statistically significant relationship between *Day of Week* and *Fasting Glucose*

Basic | Advanced

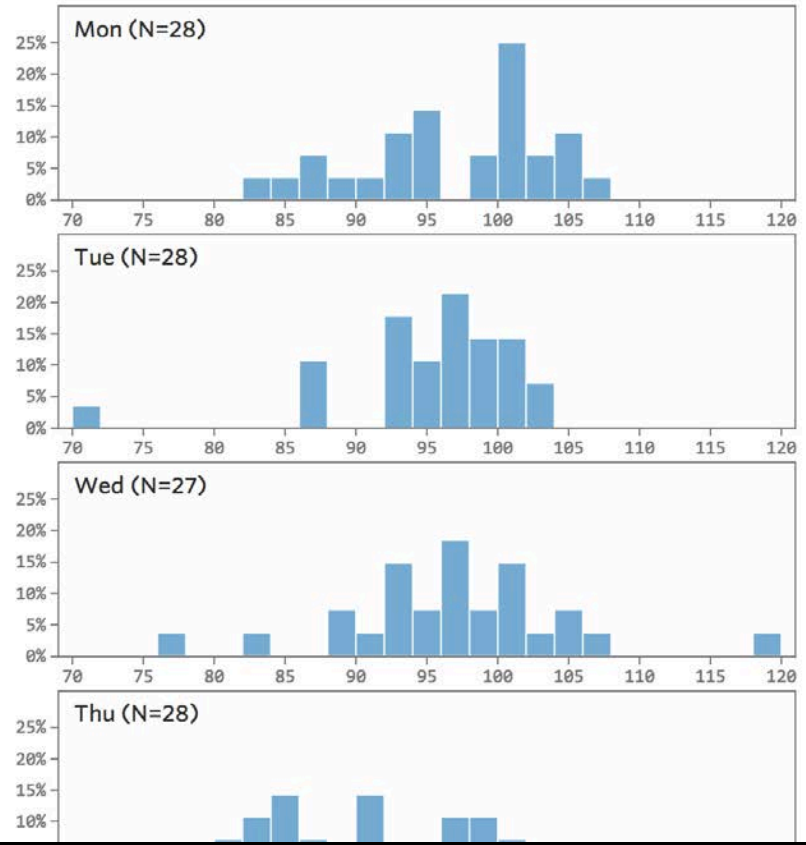
Sort ▾ | Percent | Count

Overall Statistical Relationship

Statistical Significance	Clearly significant
Effect Size	Medium

Summary

Group	Mean	Count	Sum	Higher values than which other groups?	Lower values than which other groups?
Fri	92.60	30	2,778		
Mon	96.43	28	2,700	Sat	
Sat	90.54	28	2,535		Mon, Tue, Wed
Sun	92.61	28	2,593		
Thu	91.25	28	2,555		
Tue	94.96	28	2,659	Sat	
Wed	96.41	27	2,603	Sat	
Total	93.52	197	18,423		

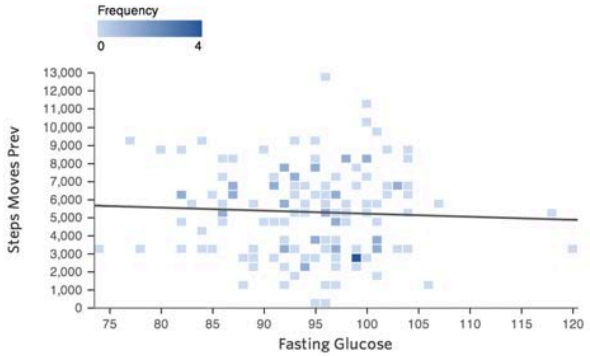


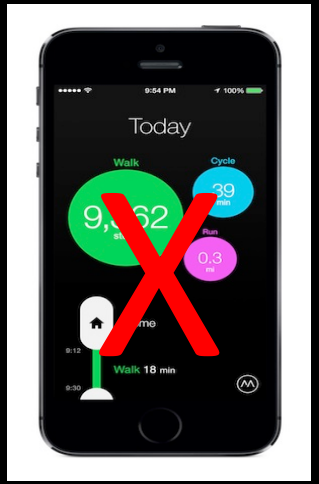
There is no statistically significant relationship between *Fasting Glucose* and *Steps Moves Prev*

Basic | Advanced

Statistical Relationship

Statistical Significance	Not significant
Effect Size	No relationship





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Basic | Advanced

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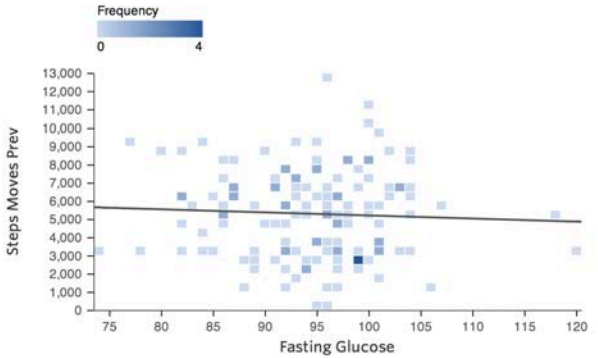



SAMSUNG
I NY
MEN'S SOCCER

No Soccer tends to have much higher values for *Fasting Glucose* than *Soccer*

Basic | Advanced

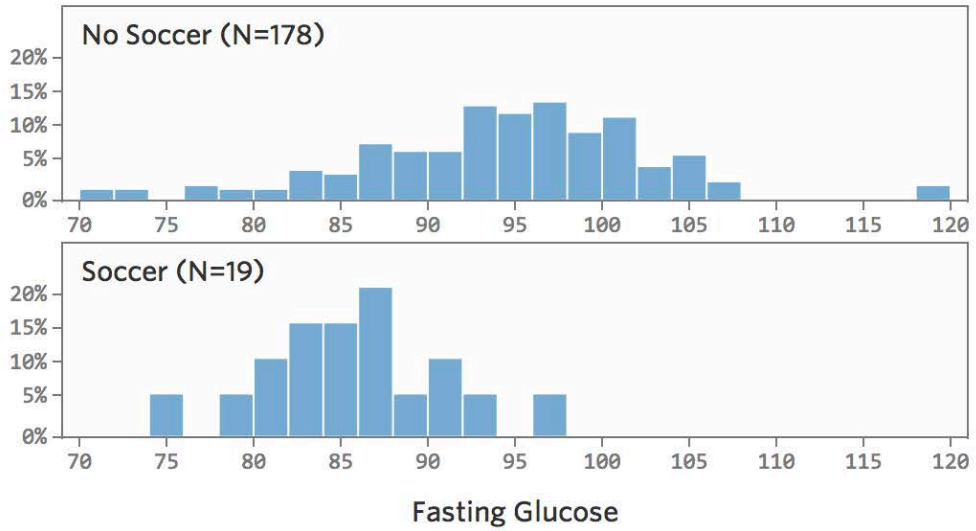
Sort | Percent | Count

Statistical Relationship

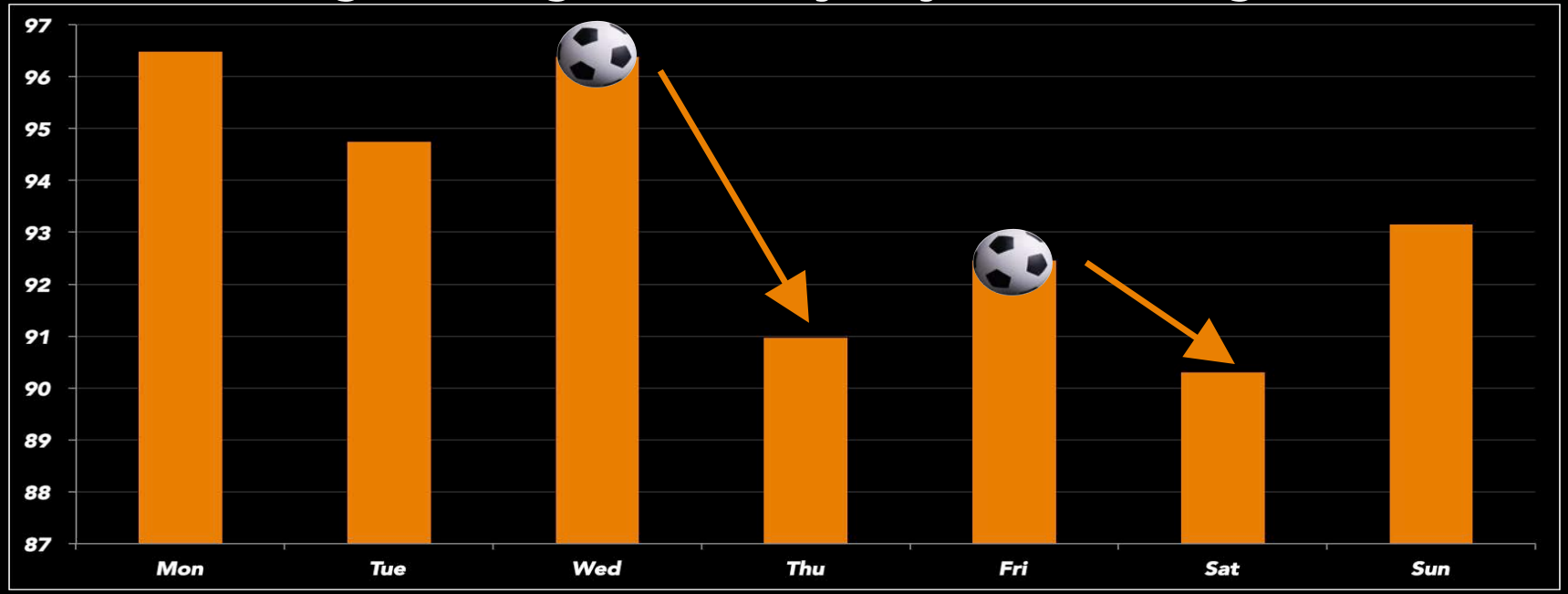
Statistical Significance	Very clearly **significant**
Effect Size	Large

Summary

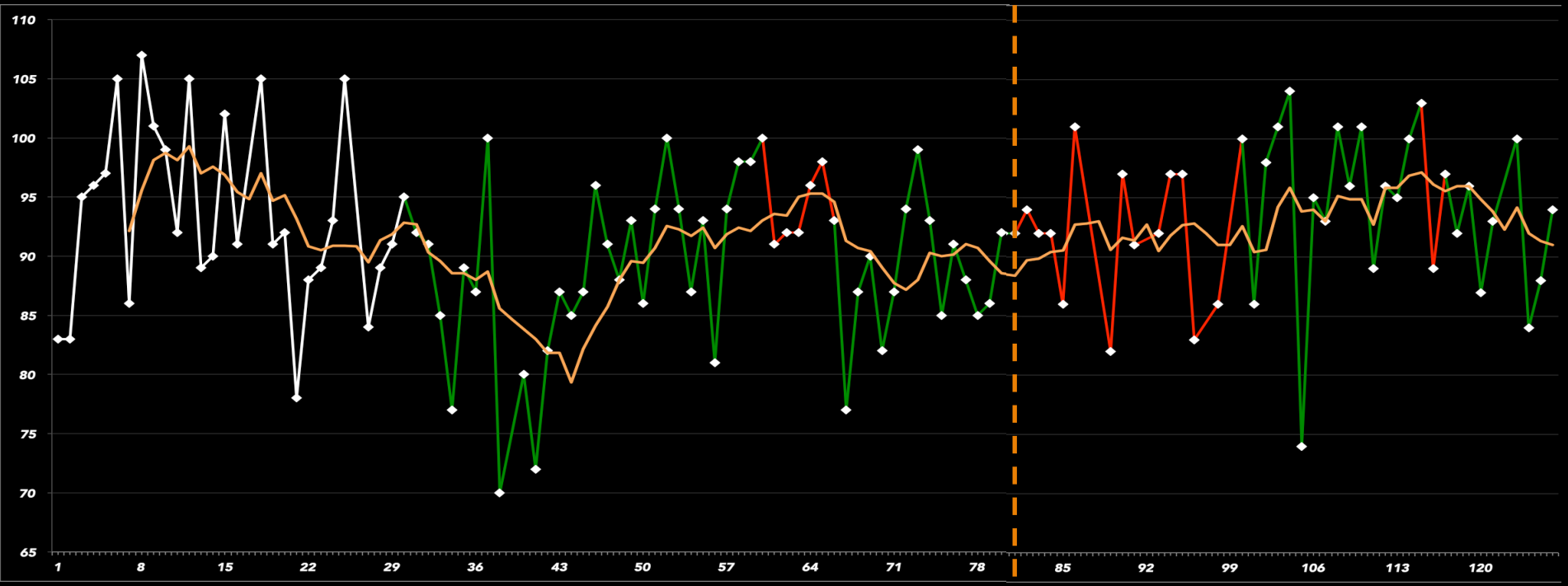
No Soccer Average	94.40
Soccer Average	85.26
Difference Between Averages	9.14



Average Fasting Glucose by Day of Week (mg/dL)



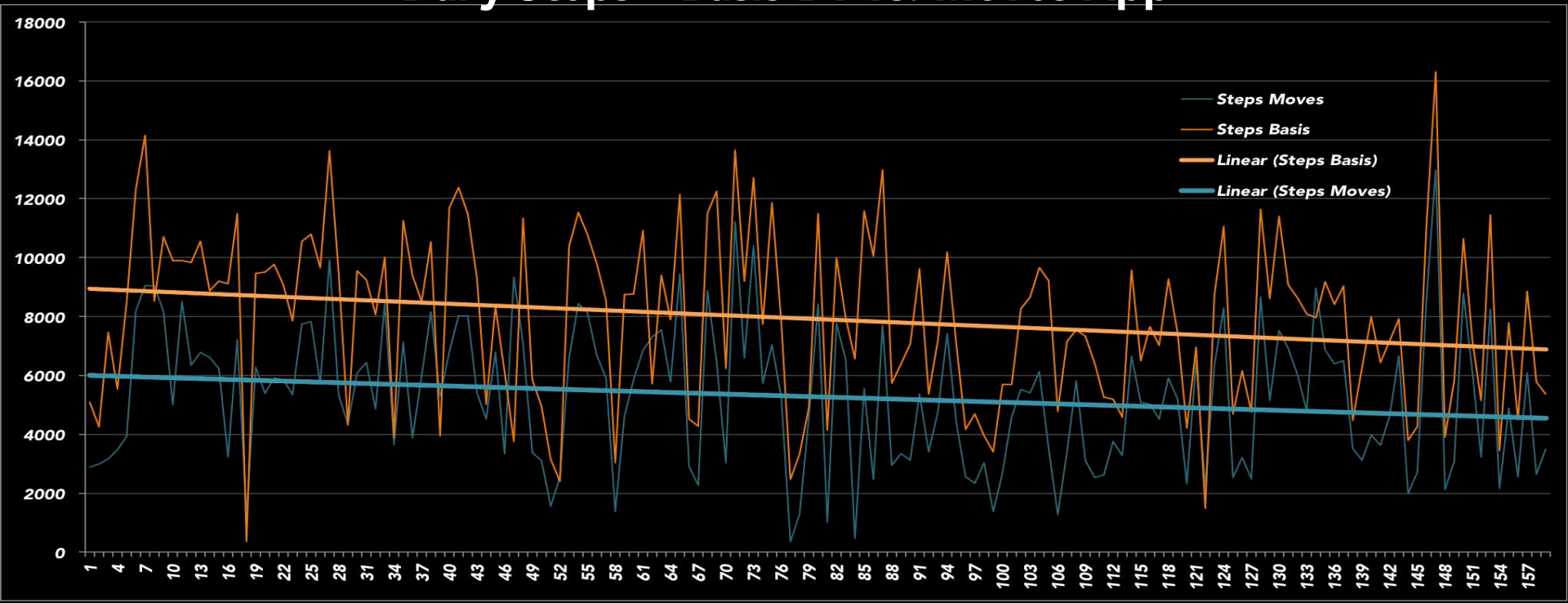
Repeat w/ Oxaloacetate = FAIL!



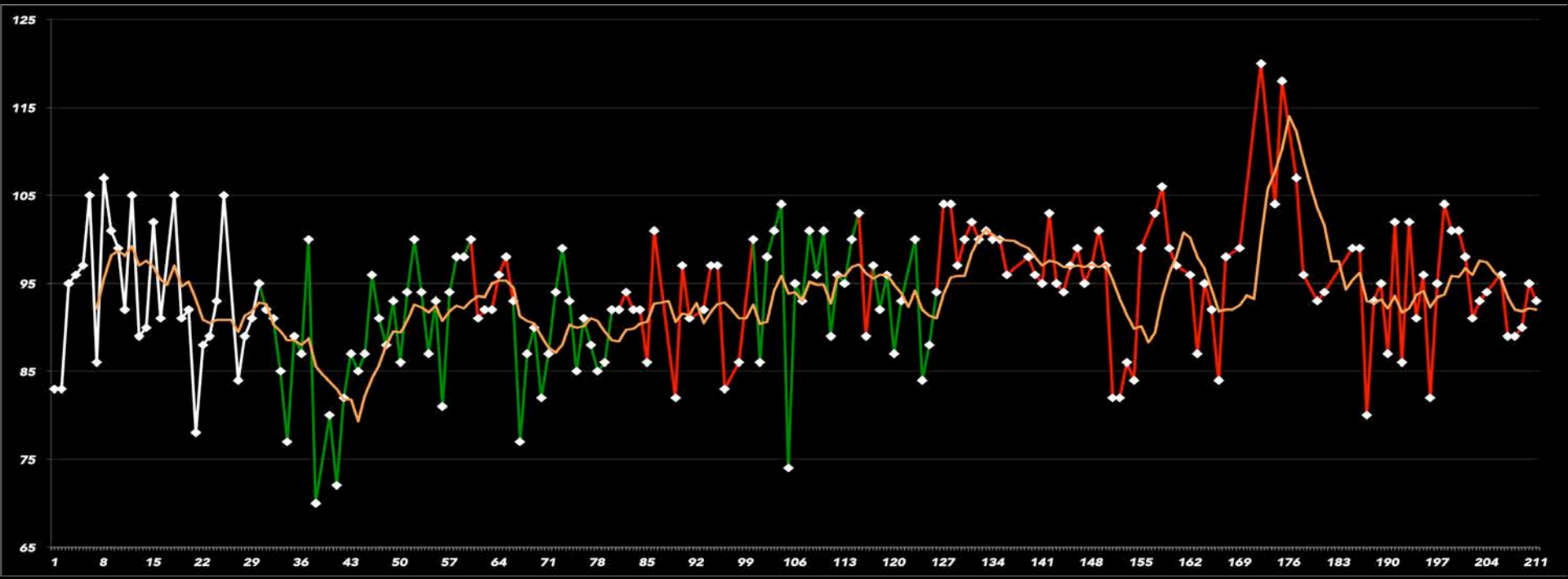
September

January

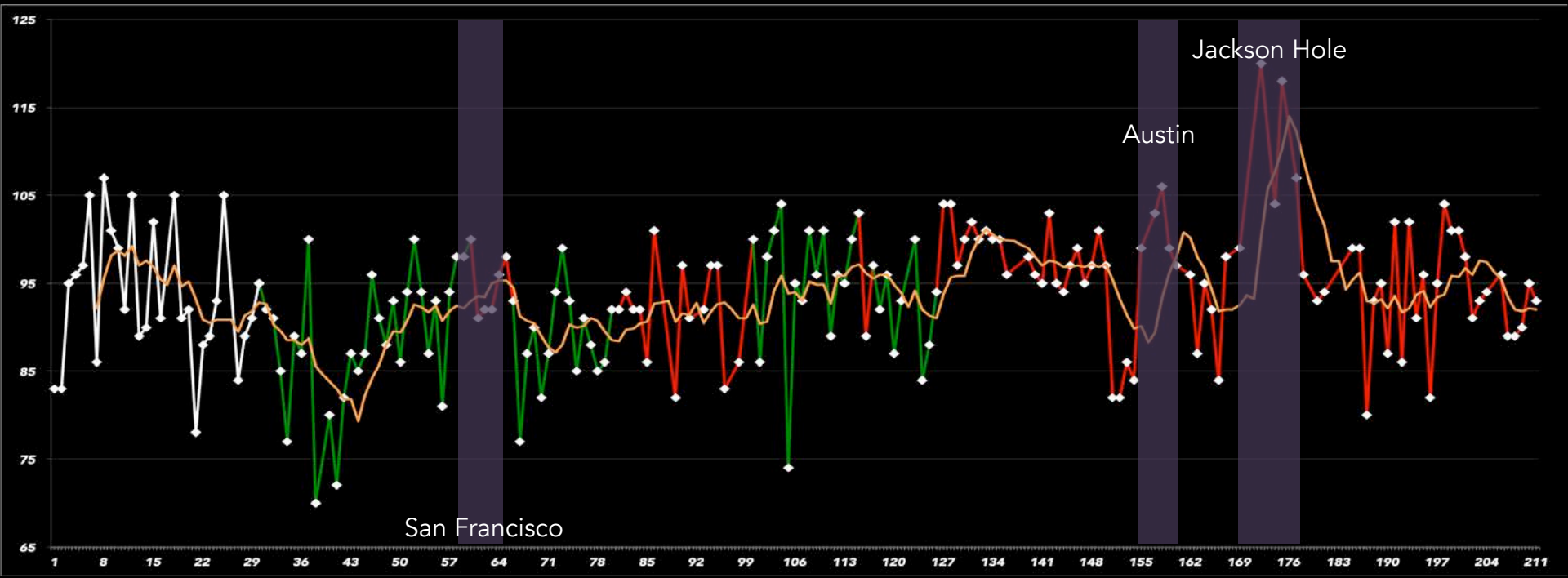
Daily Steps – Basis B1 vs. Moves App



Daily Fasting Glucose (mg/dL)



Daily Fasting Glucose (mg/dL)

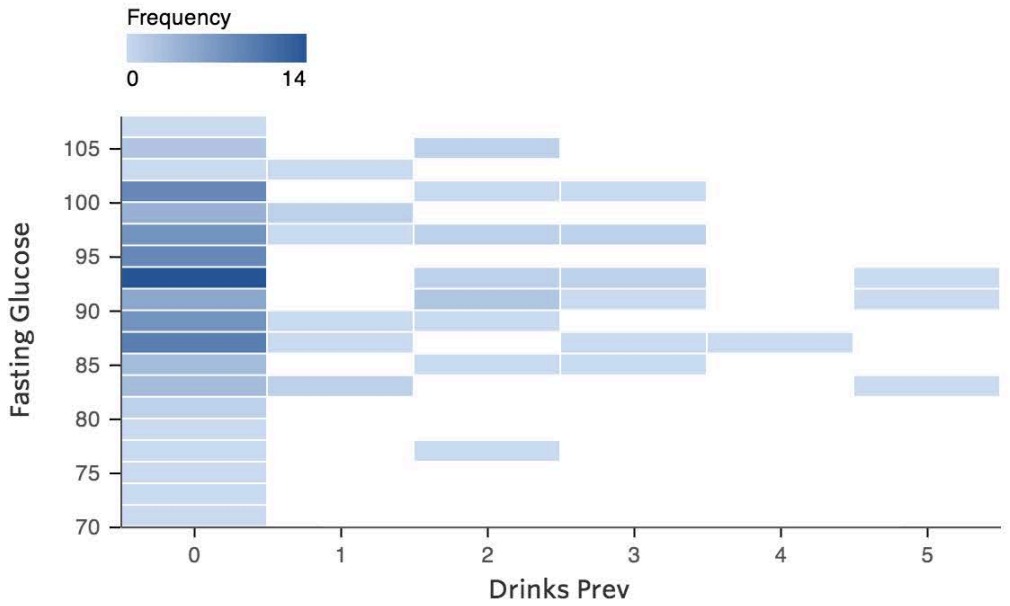


There is no statistically significant relationship between *Drinks Prev* and *Fasting Glucose*

Basic | Advanced

Statistical Relationship

Statistical Significance	Not significant
Effect Size	No relationship



What did I learn?

- **Oxaloacetate works…** but only see benefits in conjunction with intense, interval-type exercise
- **Mondays suck**, weekends are awesome!
- **Playing soccer has an effect** on lowering fasting glucose the following day

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- **Travel seems to negatively affect** glucose for several days – oxaloacetate may help
- **Most devices never 100% accurate** (or even 95%) but as long as they are consistently off can still see trends

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- **Most devices never 100% accurate** (or even 95%) but as long as they are consistently off can still see trends

- **Failure != FAIL** ☺ - can be some very valuable data (or force you to look at your data in other ways)

What will I do NEXT?

- Continuous monitoring - 24/7 readings (before/during/after meals, exercise, sleep, sex)
- Effects of sitting all day vs. standing
- Sleep, stress/HRV, mood
- Test out other natural supplements known to regulate glucose (berberine, pterostilbene, etc.)
- Track other diet variables (low/med/high carb days), specific ingredients, meal times, etc.
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Thanks! / Bedankt!

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