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Alumni Exchange

Health benefits of Intermittent fasting

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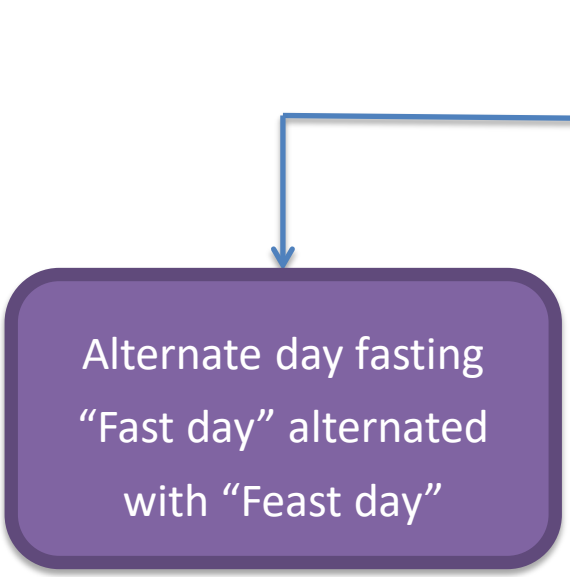
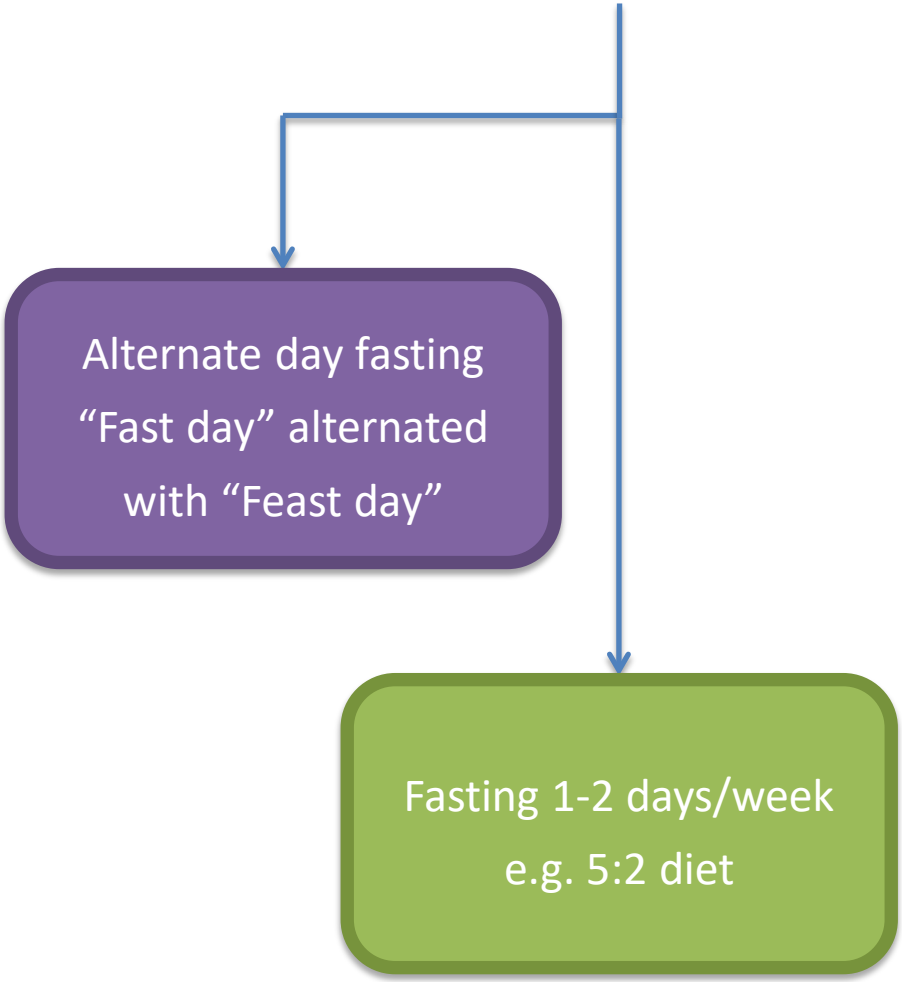
What is intermittent fasting?

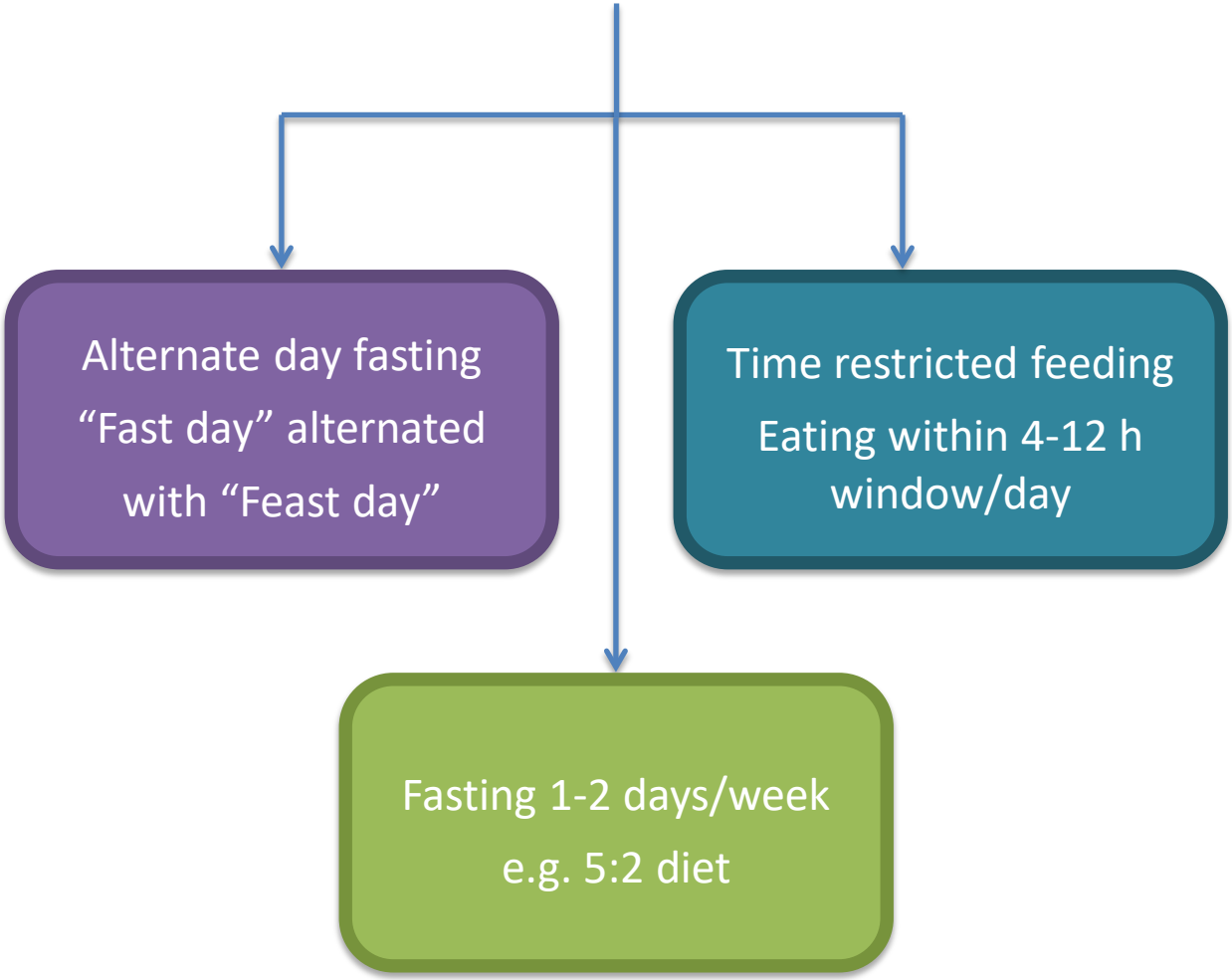
Intermittent fasting



Intermittent fasting

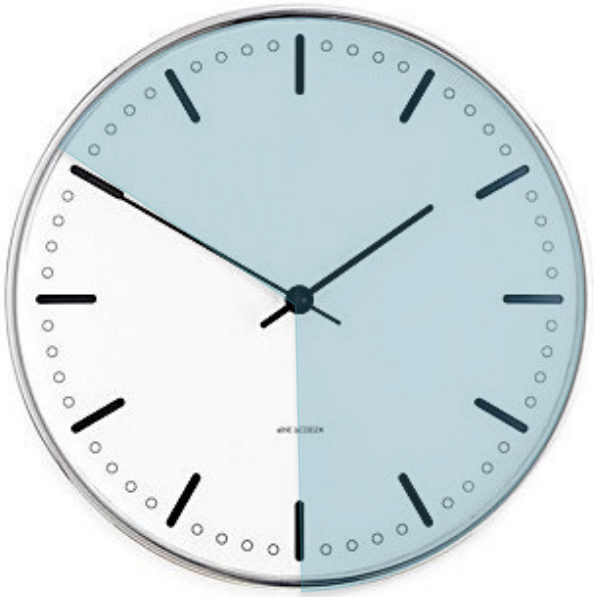


Intermittent fasting

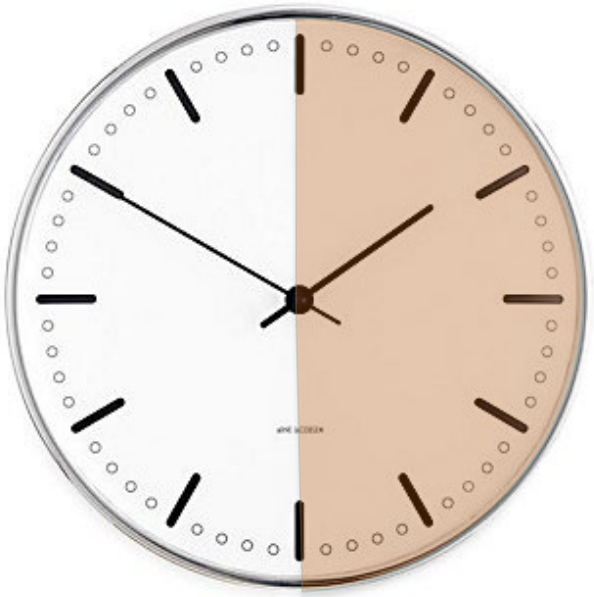


Time restricted feeding (TRF)

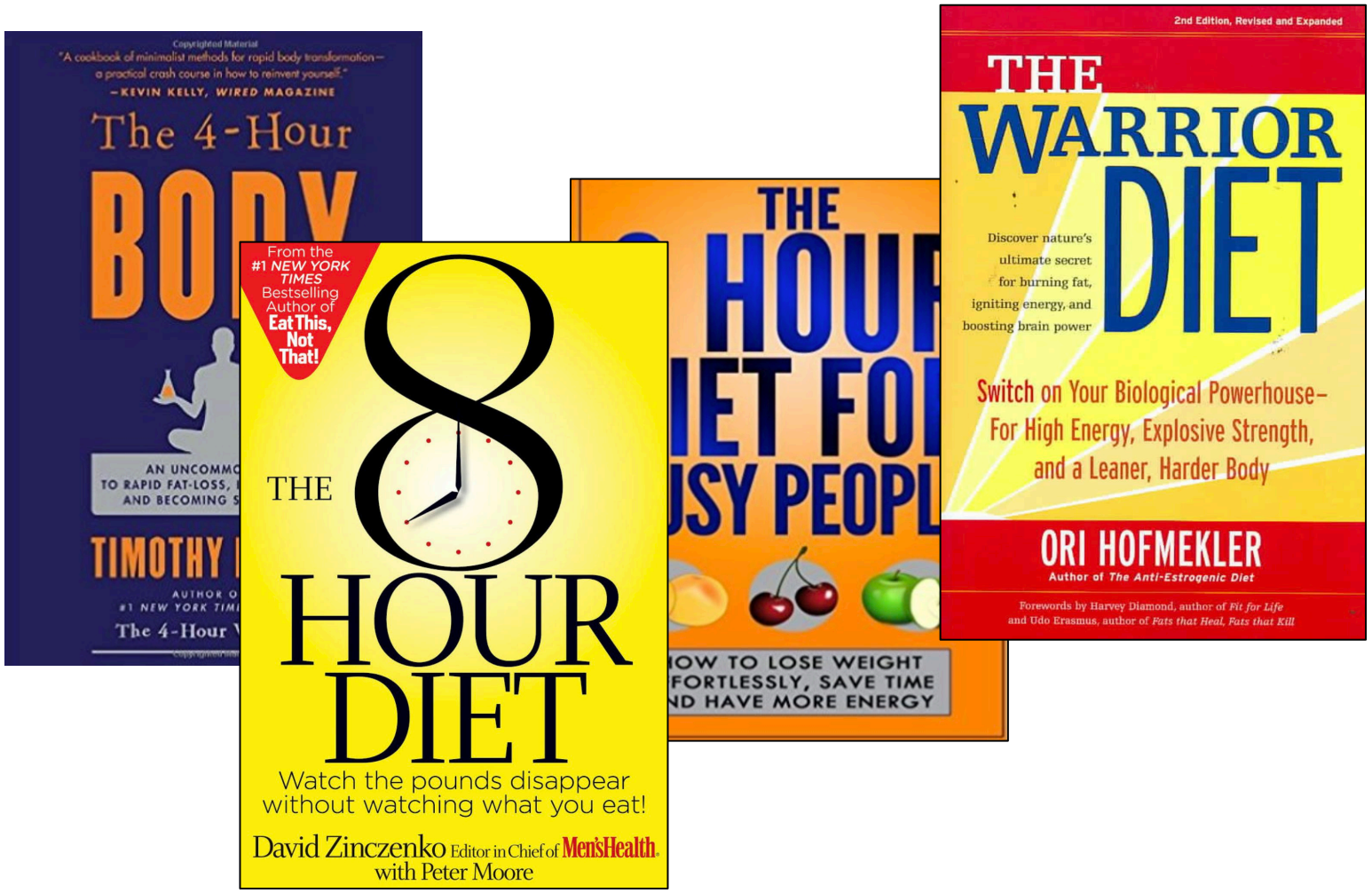
Eating within an 8-h window
10am-6pm



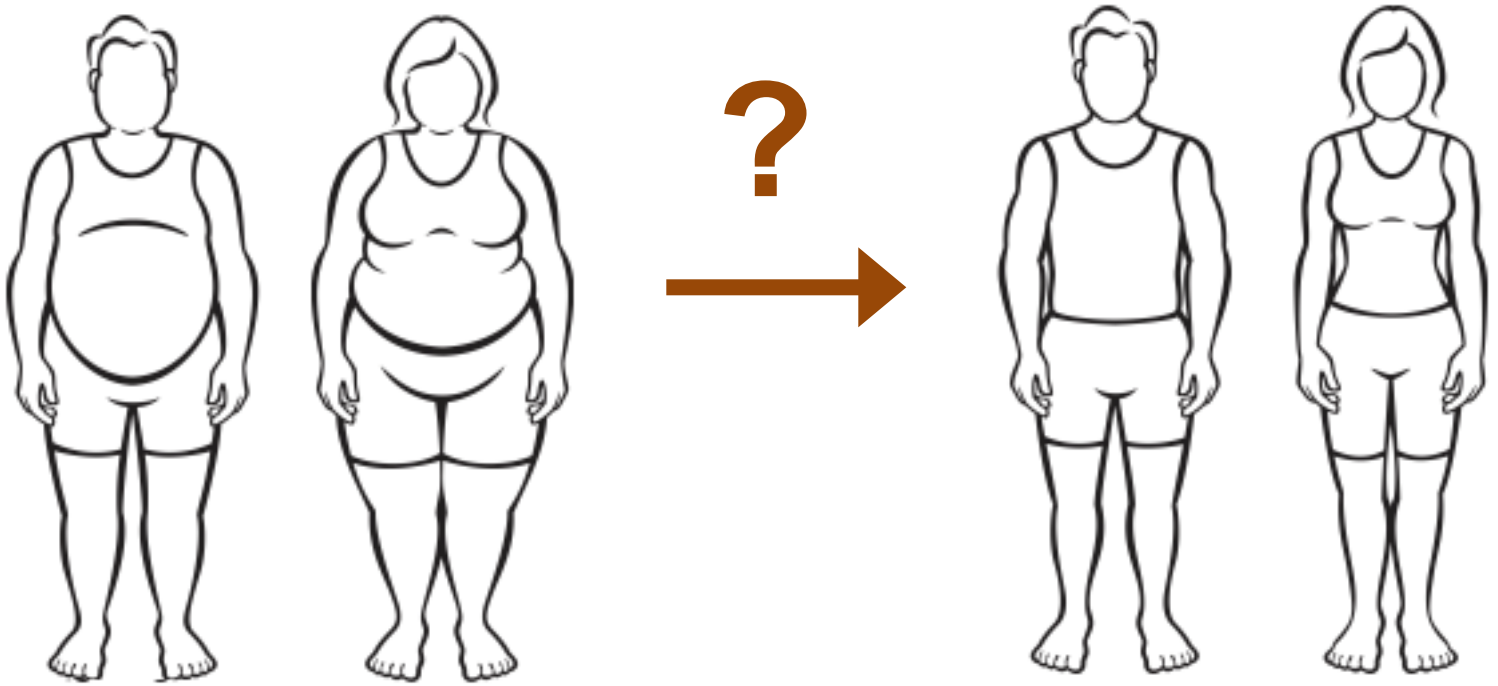
Eating within an 6-h window
12pm-6pm



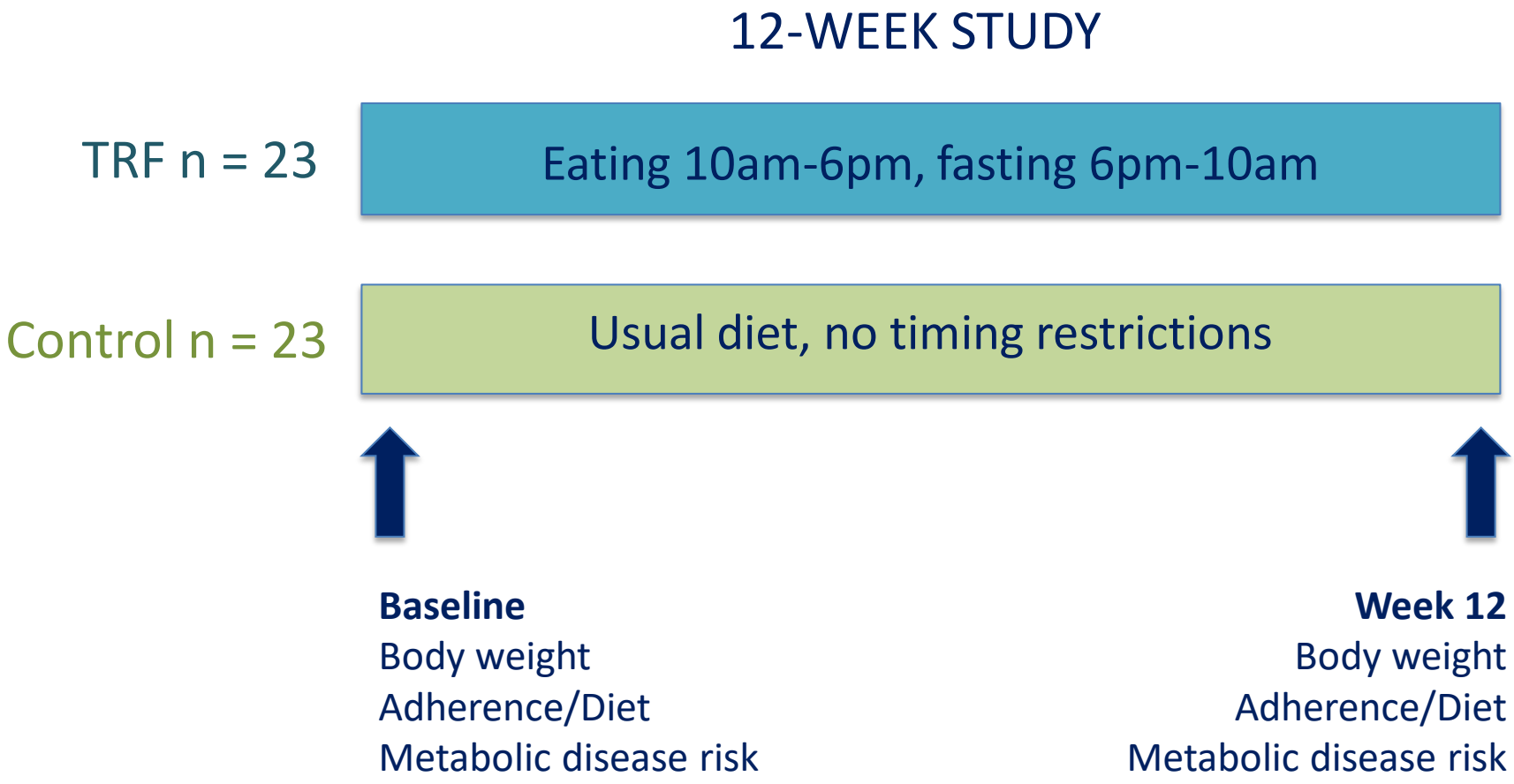
Lots of TRF books, but few human trials!



Time restricted feeding effective for weight loss in individuals with obesity?



Experimental design – 8h TRF study



Gabel et al. 2018. Nutr Healthy Aging

TRF = No calorie monitoring necessary!

Just watch the clock

Log - Adherence and timing of food intake

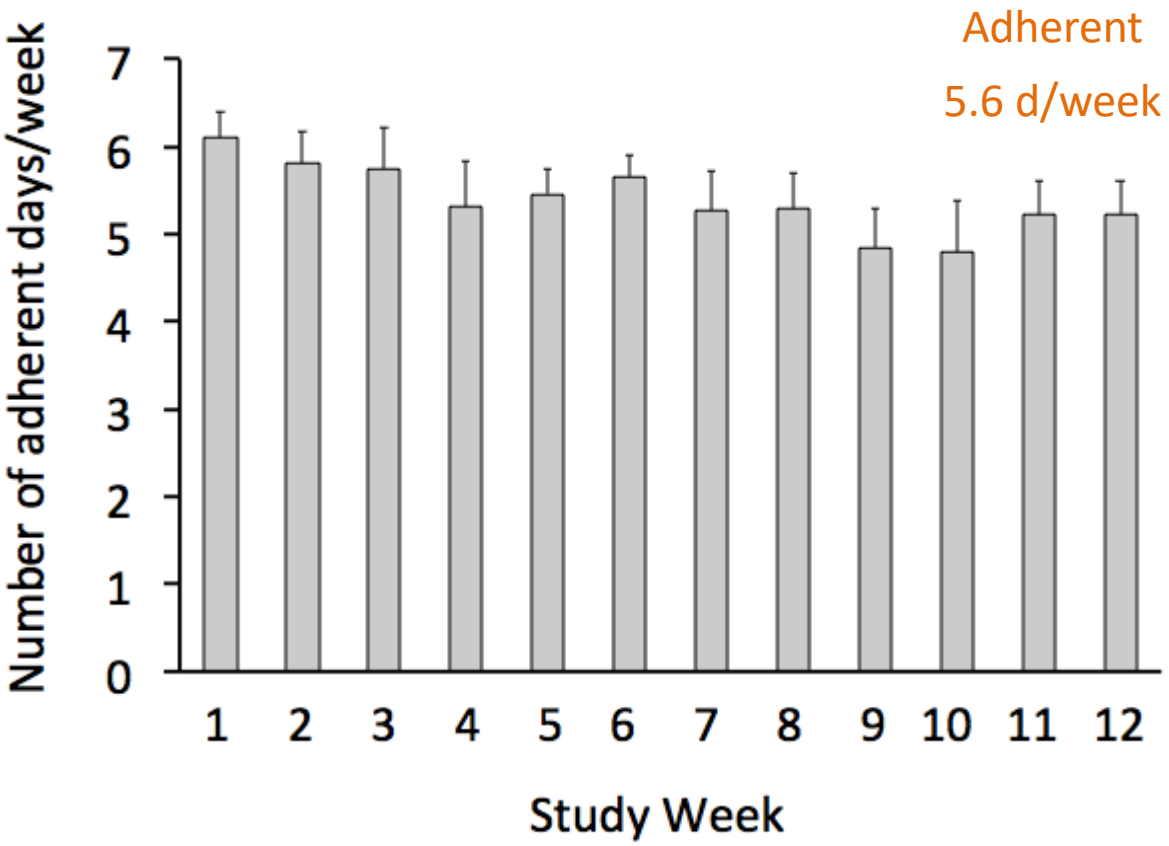
Timing of food intake log **Subject ID: _____ Study week: _____**

Day	Date	Start eating Time	Stop eating Time	To be completed by dietician (leave blank)	
				Adherent	Not adherent
Monday				☐	☐
Tuesday				☐	☐
Wednesday				☐	☐
Thursday				☐	☐
Friday				☐	☐
Saturday				☐	☐
Sunday				☐	☐

Gabel et al. 2018. Nutr Healthy Aging

7-d food record used to assess energy intake

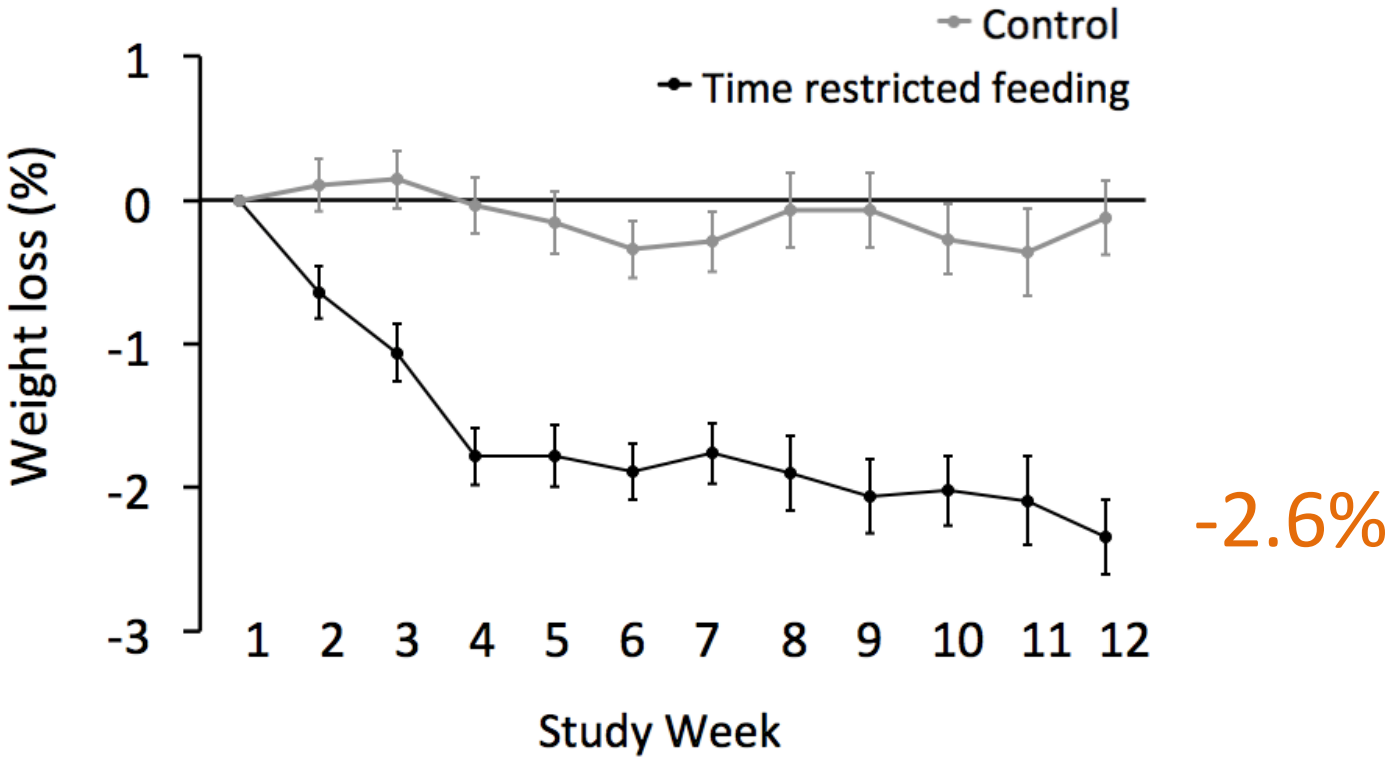
Adherence to the 8h feeding window



All values reported as mean ± SEM. TRF group was compliant with the prescribed eating window on 5.6 ± 0.3 d/week, and this level of adherence did not change over the course of the trial.

Gabel et al. 2018. Nutr Healthy Aging

Weight loss by 8h TRF



All values reported as mean ± SEM. Data were included for 46 participants; means were estimated using an intention-to-treat analysis using last observation carried forward. Body weight decreased in the time restricted feeding group relative to controls over 12 weeks ($P < 0.001$).

Gabel et al. 2018. Nutr Healthy Aging

Unintentional calorie restriction - 8h TRF

8h reduced energy intake by ~350 kcal/d

	Time restricted feeding (n = 23)		Control (n = 23)		P-value Time × group
	Baseline	Week 12	Baseline	Week 12	
Energy (kcal)	1676 ± 114	1335 ± 162	1645 ± 113	1654 ± 191	0.04
Protein (%)	16 ± 1	17 ± 1	17 ± 1	17 ± 1	0.40
Carbohydrates (%)	47 ± 2	46 ± 2	46 ± 2	45 ± 2	0.61
Fat (%)	37 ± 1	37 ± 2	37 ± 1	38 ± 2	0.74
Cholesterol (mg)	279 ± 24	214 ± 27	275 ± 27	265 ± 37	0.32
Fiber (g)	16 ± 2	13 ± 1	14 ± 1	15 ± 2	0.17

All values reported as mean ± SEM. Data were included for 46 participants; means were estimated using an intention-to-treat analysis using last observation carried forward.

Gabel et al. 2018. Nutr Healthy Aging

Changes in metabolic risk by 8h TRF

	Time restricted feeding (n = 23)		Control (n = 23)		P-value Time × group
	Baseline	Week 12	Baseline	Week 12	
Systolic BP (mm Hg)	128 ± 4	121 ± 3	123 ± 4	124 ± 3	0.02
Diastolic BP (mm Hg)	83 ± 2	82 ± 2	81 ± 2	82 ± 2	0.41
Heart rate (bpm)	69 ± 2	71 ± 2	73 ± 2	73 ± 3	0.33
Total cholesterol (mg/dl)	177 ± 7	178 ± 9	192 ± 7	185 ± 7	0.15
LDL cholesterol (mg/dl)	108 ± 5	110 ± 7	114 ± 7	112 ± 6	0.54
HDL cholesterol (mg/dl)	48 ± 2	49 ± 2	61 ± 3	55 ± 2	0.11
Triglycerides (mg/dl)	105 ± 11	93 ± 9	89 ± 7	89 ± 11	0.43
Fasting glucose (mg/dl)	79 ± 4	82 ± 2	87 ± 2	87 ± 2	0.77
Fasting insulin (uIU/ml)	8.3 ± 1.0	5.7 ± 0.7	9.2 ± 1.4	10.3 ± 1.9	0.16
HOMA-IR	1.6 ± 0.2	1.0 ± 0.2	2.0 ± 0.3	2.2 ± 0.4	0.21

Gabel et al. 2018. Nutr Healthy Aging

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HOMA-IR	1.6 ± 0.2	1.0 ± 0.2	2.0 ± 0.3	2.2 ± 0.4	0.21

Gabel et al. 2018. Nutr Healthy Aging

Is time restricted feeding (TRF) safe?

Self-reported adverse events during 8h TRF

Adverse events	Baseline (%)	Wk 1 (%)	Wk 12 (%)	*P*
Gastrointestinal				
Nausea	0	0	6	1.00
Vomiting	0	0	0	1.00
Diarrhea	0	0	12	1.00
Constipation	17	29	24	1.00
Bad Breath	18	14	12	0.50
Dry Mouth	32	14	12	0.13
Neurological				
Dizziness	9	0	18	1.00
Weakness	14	0	6	0.50
Headache	32	24	24	0.50
Fatigue	14	10	12	1.00
Irritability	23	19	6	0.25
Unhappiness	14	14	0	1.00

Note: Values reported as mean percent occurrences at each time point (baseline: $n = 23$; week 1: $n = 23$; week 12: $n = 17$). Baseline values were measured 2 weeks before the start of the intervention (week 1). *P* value: McNemar's test.

Gabel et al. 2019. Appl Physiol Nutr Metab

Eating disorder symptoms during 8h TRF

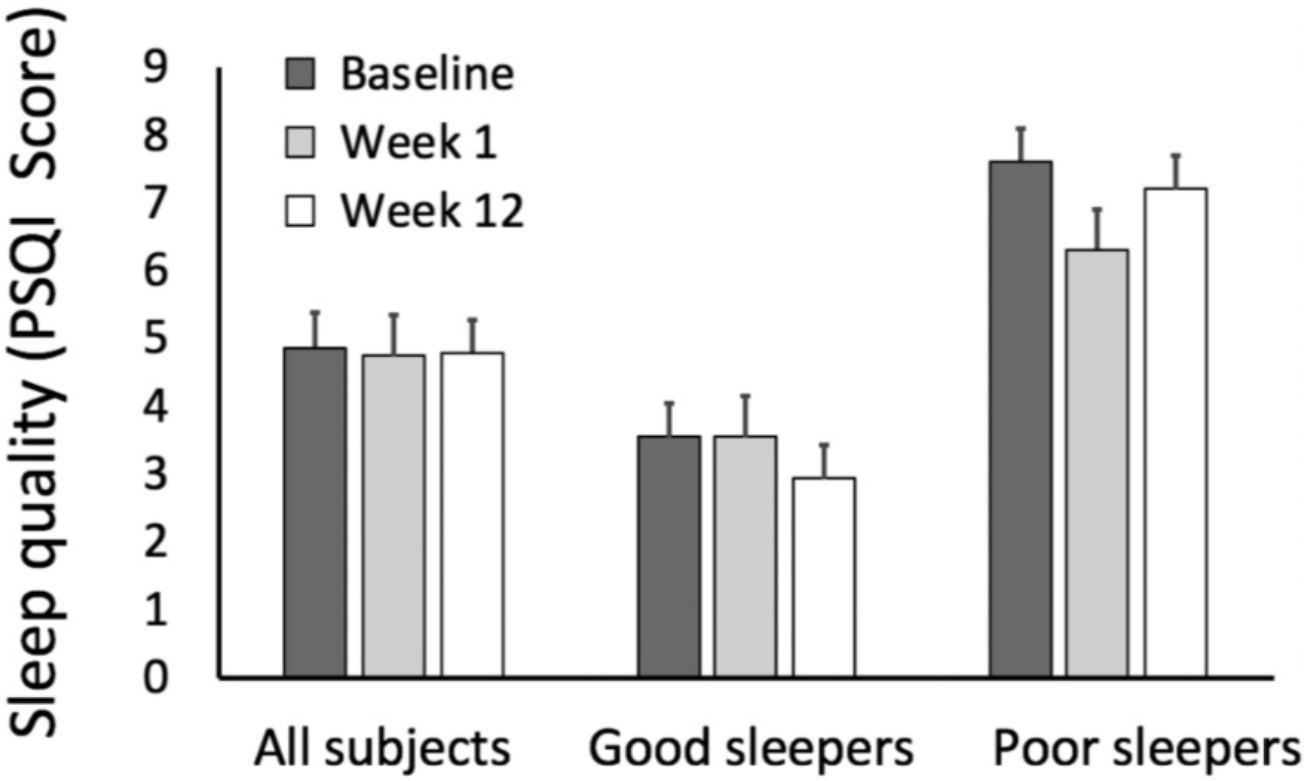
	Baseline	Wk 1	Wk 12	*P*
Eating disorder symptoms				
Depression	32±1	32±1	32±1	0.90
Binge Eating	28±2	27±1	27±1	0.79
Purgative behavior	13±1	11±1	12±1	0.23
Fear of fatness	41±2	39±2	41±2	0.89
Restrictive eating	28±2	27±2	29±2	0.68
Avoidance of forbidden foods	37±2	38±2	38±2	0.93
Body image perception				
Concerns about body size/shape	47±3	46±3	47±3	0.96
Eating behaviors				
Dietary restraint	17±1	16±1	17±1	0.51
Uncontrolled eating	18±1	18±1	18±1	0.89
Emotional eating	7±1	7±1	6±1	0.96

Note: Values reported as means ± SEM (baseline: $n = 23$; week 1: $n = 23$; week 12: $n = 17$). Baseline values were measured 2 weeks before the start of the intervention (week 1). *P* value: ANOVA.

Gabel et al. 2019. Appl Physiol Nutr Metab

But won’t I be too hungry to sleep?

Sleep quality after 12 weeks of 8-h TRF



Pittsburgh Sleep Quality Index (PSQI) questionnaire. "All subjects" (*n* = 23).
"Good sleepers" (*n* = 13) PSQI total score equal to or below 5 at baseline
"Poor sleepers" PSQI total score greater than 5 at baseline (*n* = 10).
No significant changes between baseline, week 1, and week 12 in any group.

Gabel et al. 2019. Appl Physiol Nutr Metab

Summary of findings – 8h TRF

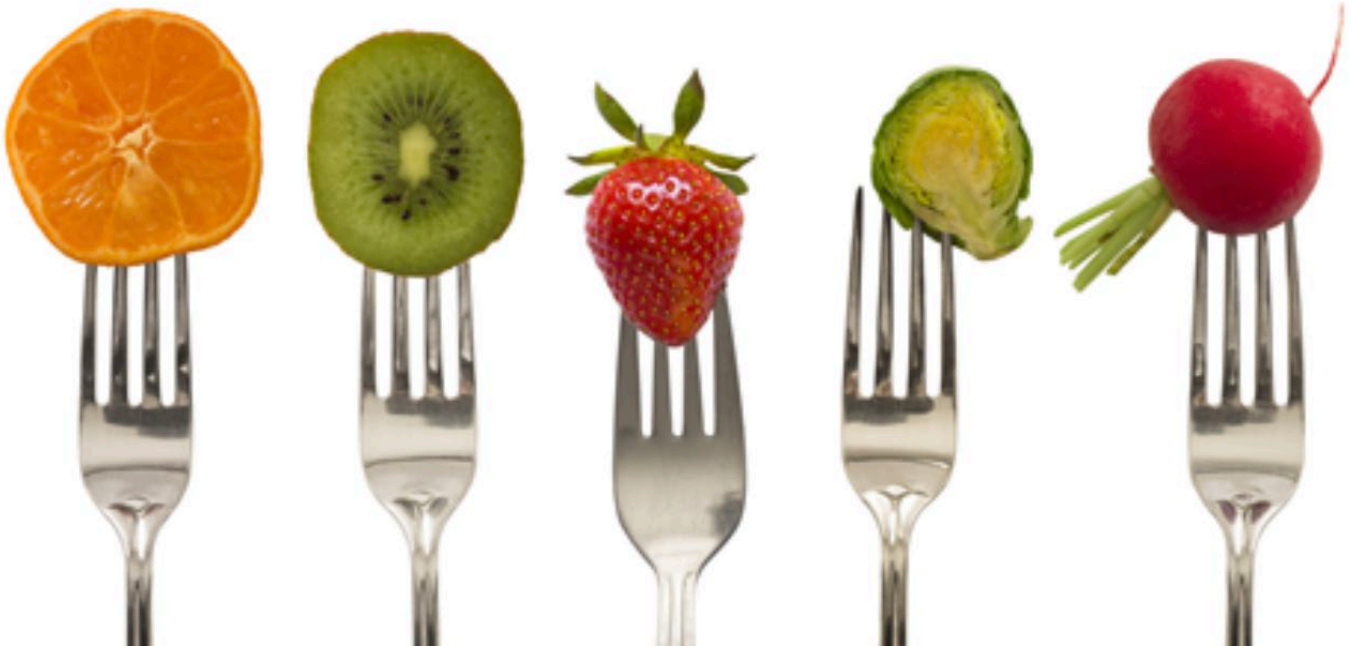
Body weight

- ~3% weight loss in 3 months
- Self-reported adherence was high (80%)
- Unintentional kcal restriction (~350 kcal/d)

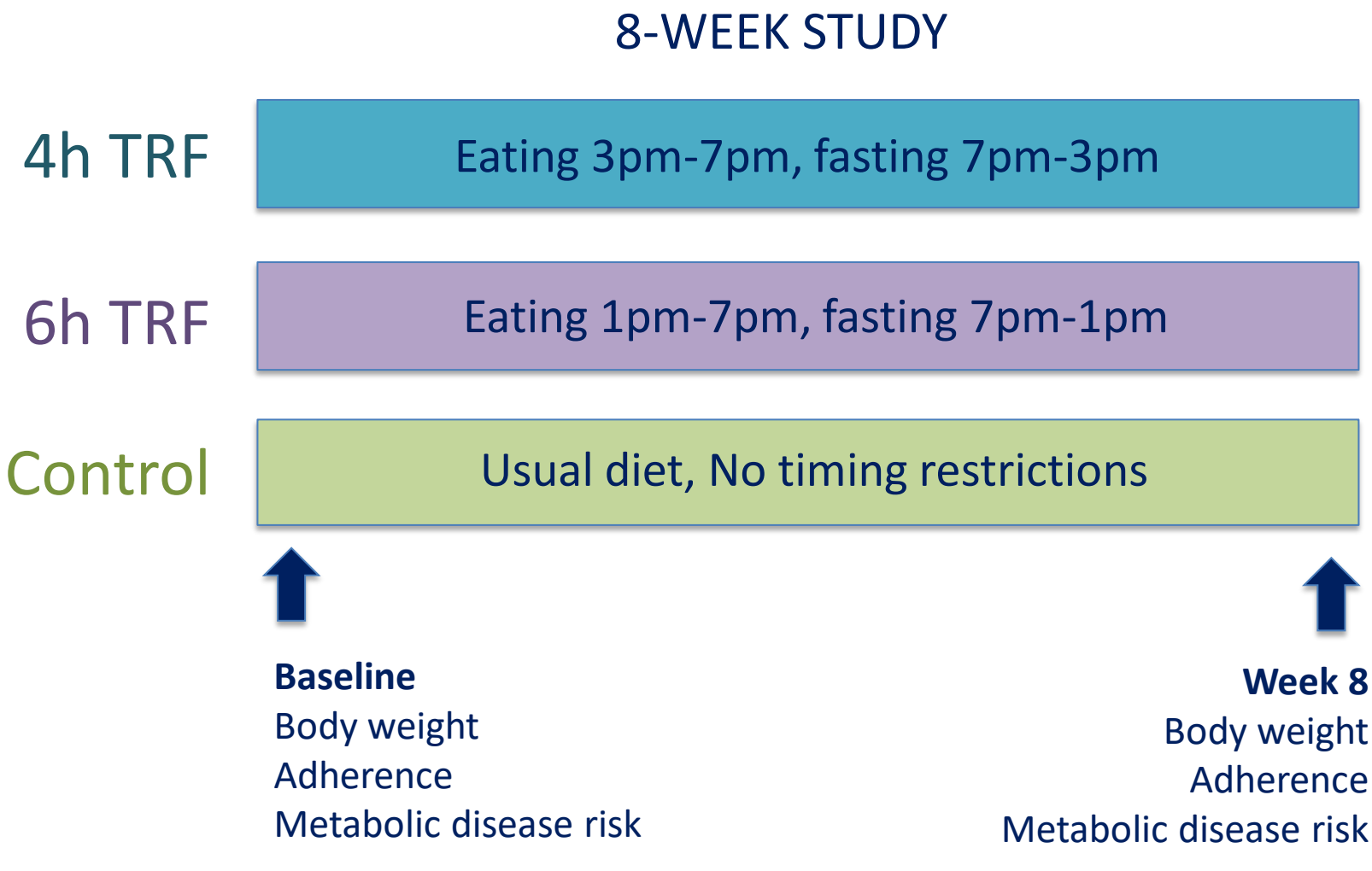
Metabolic disease risk and safety

- Systolic blood pressure decreased
- No change plasma lipids/glucoregulatory
- TRF appears to be safe

Do shorter feeding windows (4h or 6h) produce greater weight loss?

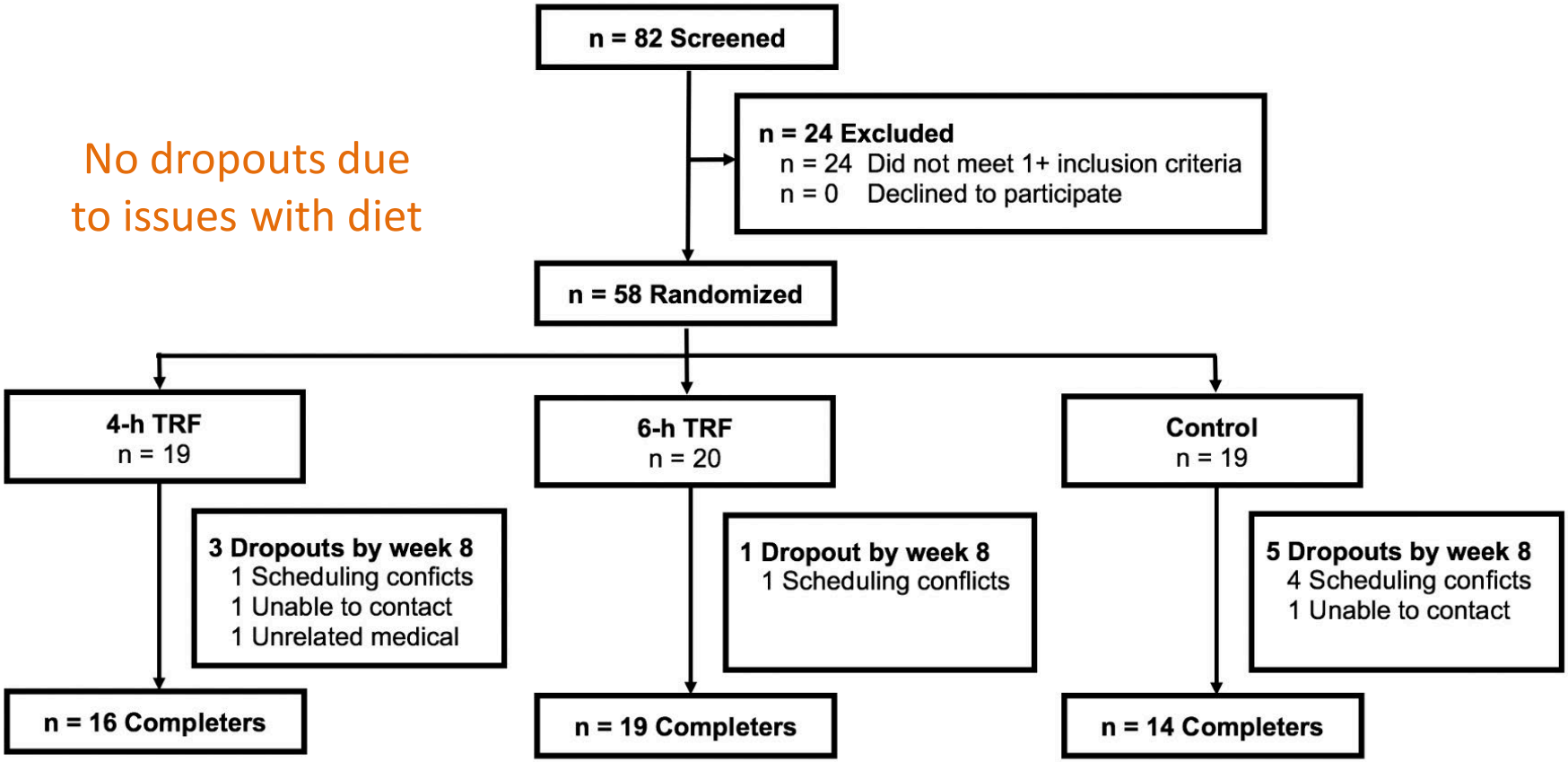


Experimental design – 4h vs 6h TRF study



Subject flow chart – 4h vs 6h TRF study

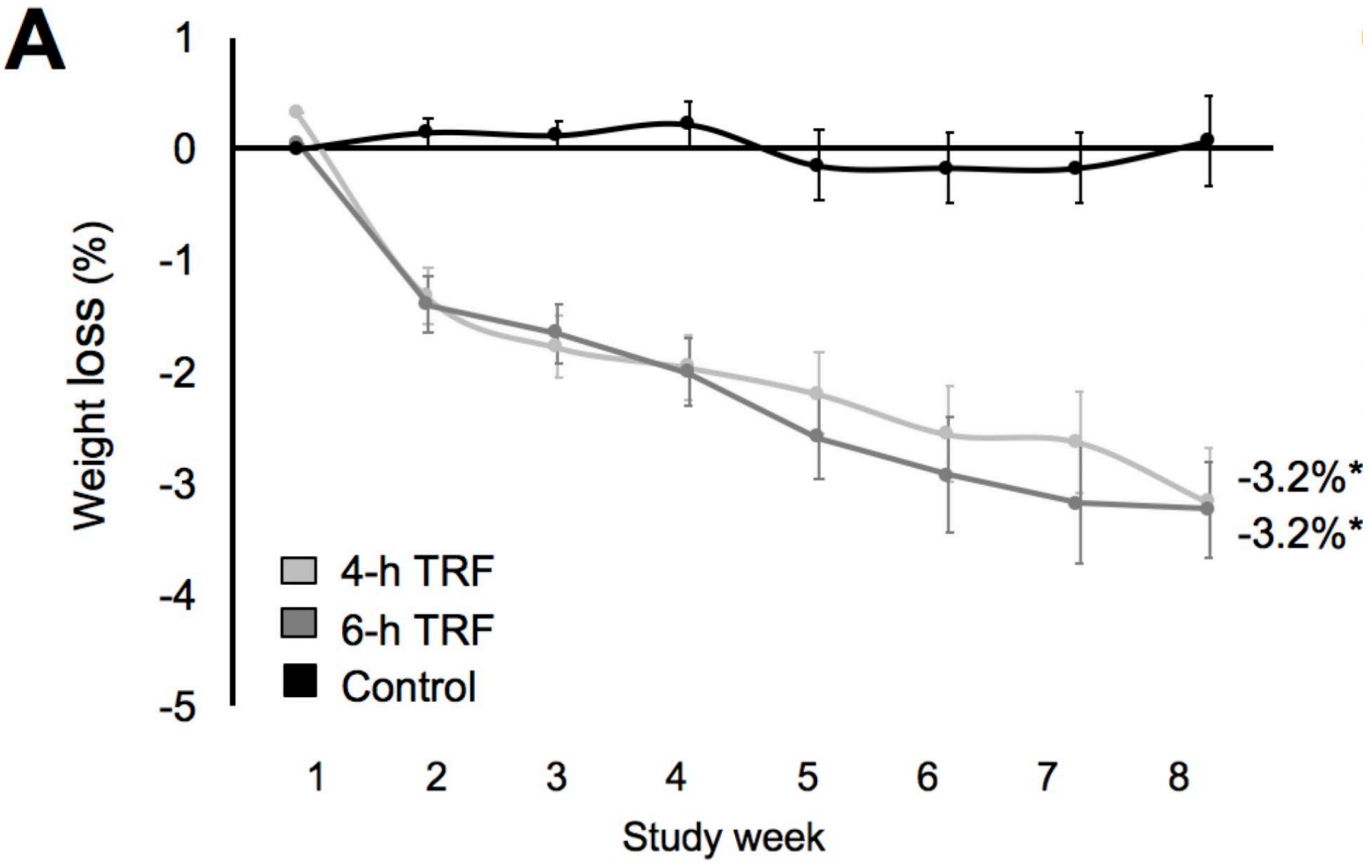
No dropouts due to issues with diet



Cienfuegos S et al. 2020. Cell Metabolism

Weight loss - 4h vs 6h TRF

4h and 6h produced similar reductions in body weight

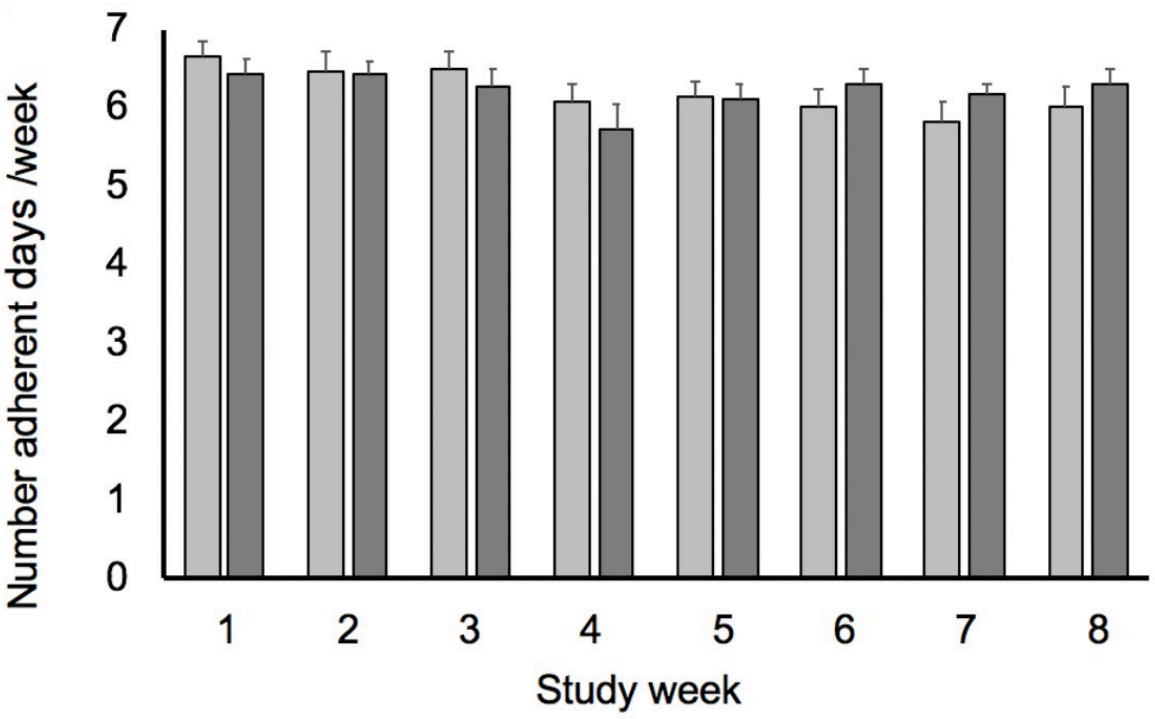


All values reported as mean ± SEM. The 4-h TRF and 6-h TRF interventions produced nearly identical weight loss, relative to controls ($P < 0.001$).

Cienfuegos S et al. 2020. Cell Metabolism

Adherence to the eating window - 4h vs 6h TRF

4h and 6h had similar adherence to the eating window



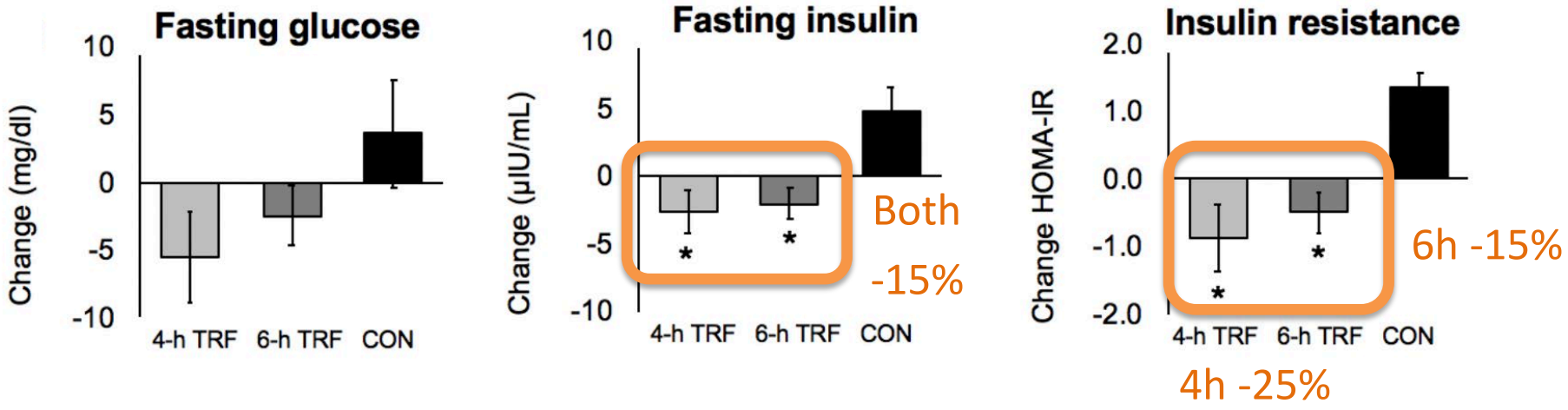
Both groups adherent: 6.2 d/week

All values reported as mean ± SEM. 4 h and 6 h TRF were compliant with their prescribed eating windows on 6.2 ± 0.2 d/week, and this level of adherence did not change over the course of the trial.

Cienfuegos S et al. 2020. Cell Metabolism

Glucoregulatory factors - 4h vs 6h TRF

4h and 6h produced similar reductions in insulin and insulin resistance

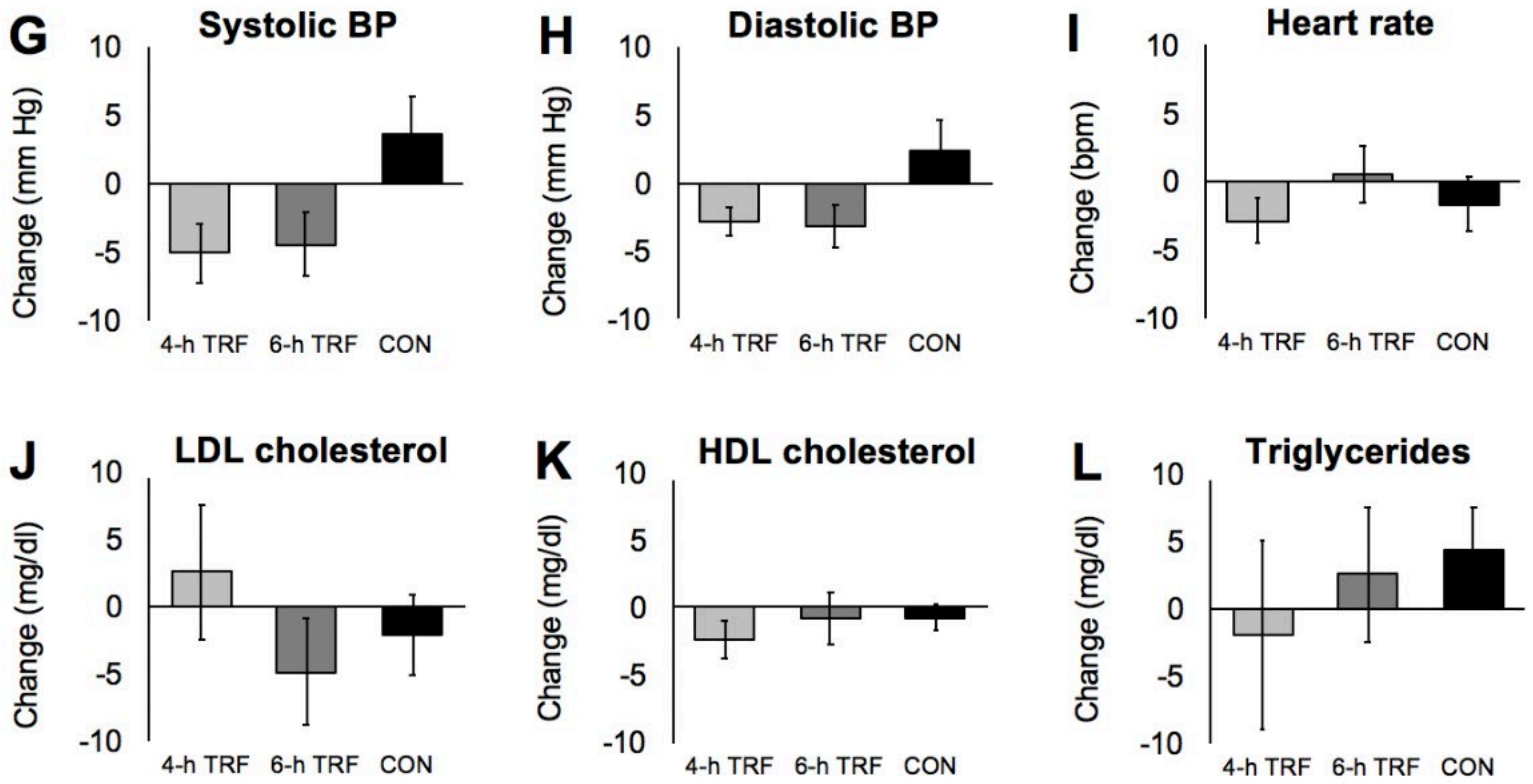


All values reported as mean ± SEM. Fasting glucose was not affected by either 4-h or 6-h TRF. Fasting insulin and insulin resistance decreased similarly by 4-h TRF and 6-h TRF. *P < 0.05 relative to controls.

Cienfuegos S et al. 2020. Cell Metabolism

Blood pressure and lipids - 4h vs 6h TRF

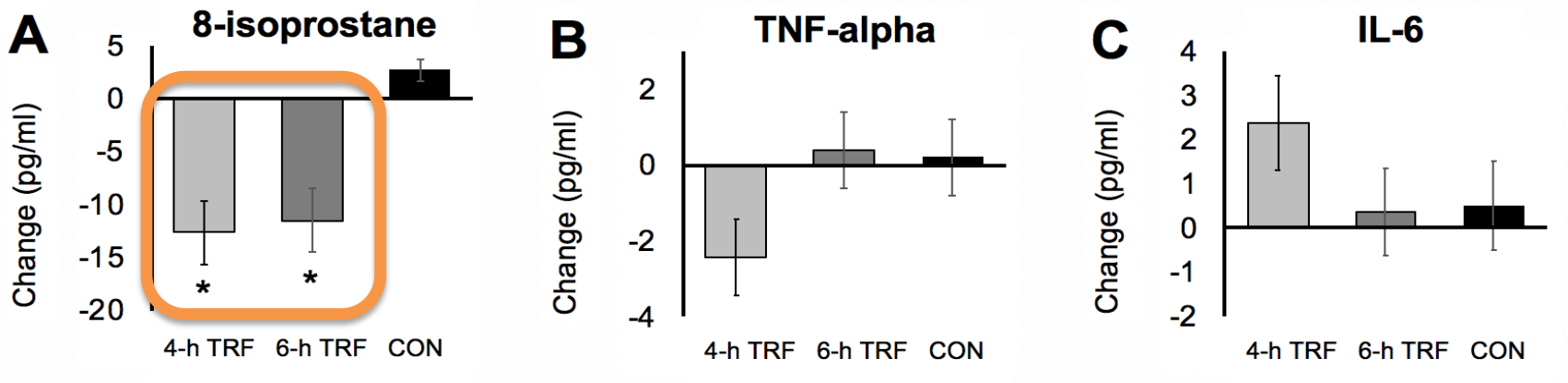
4h and 6h have no effect on blood pressure or plasma lipids



Cienfuegos S et al. 2020. Cell Metabolism

Oxidative stress and inflammation - 4h vs 6h TRF

4h and 6h produce similar reductions oxidative stress



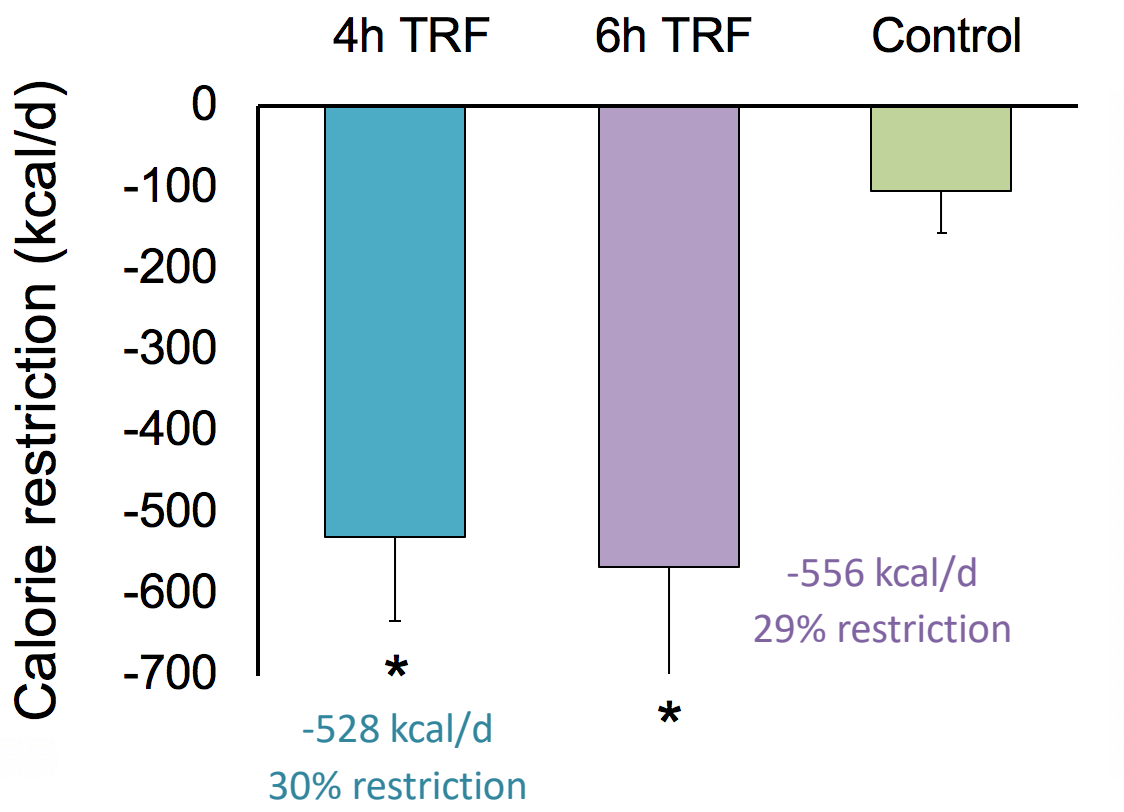
Both -35%

All values reported as mean ± SEM. 4-h and 6-h TRF produced similar decreases in 8-isoprostane (marker of oxidative stress to lipids). Inflammatory markers were not changed. *P < 0.05 vs controls.

Cienfuegos S et al. 2020. Cell Metabolism

Unintentional calorie restriction - 4h vs 6h TRF

4h and 6h produced similar reductions energy intake (~550 kcal/d)



All values reported as mean ± SEM. Comparable decreases in energy intake were observed in the 4h TRF group and 6-h TRF group, versus controls. *P < 0.05 relative to controls.

Summary of findings – 4h vs 6h TRF

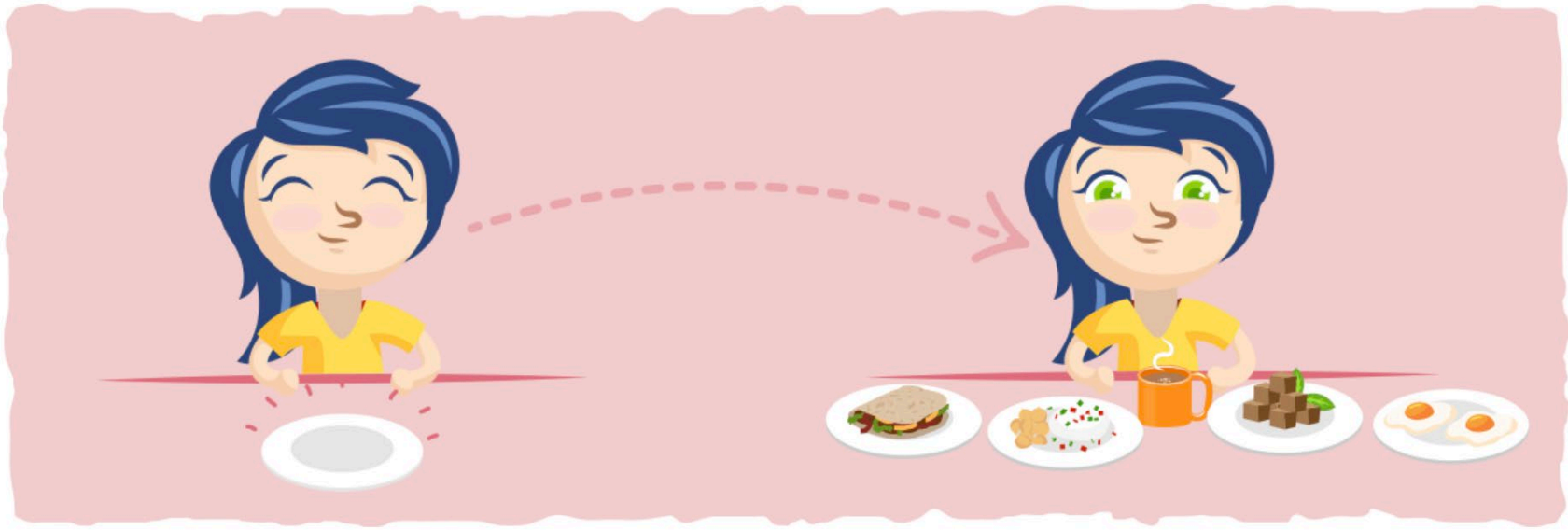
Body weight (similar findings 4h vs 6h)

- ~3% weight loss in 2 months
- Self-reported adherence was high (90%)
- Unintentional kcal restriction (~550 kcal/d)

Metabolic risk reductions (similar 4h vs 6h)

- Insulin and insulin resistance
- Oxidative stress
- No effect on lipids/inflammation

Alternate day fasting



Alternate day fasting

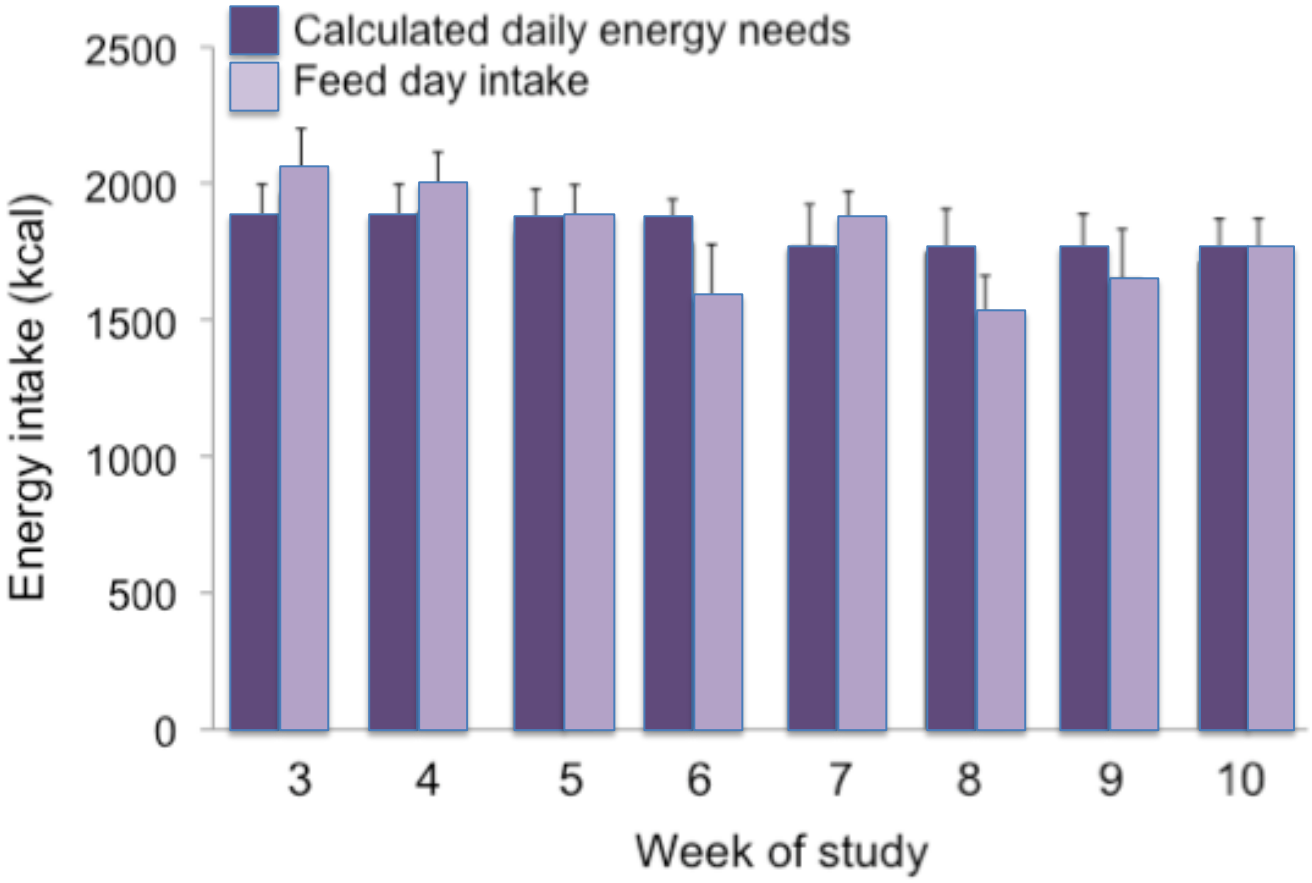
Feast day

Day of ad libitum feeding

Fast day

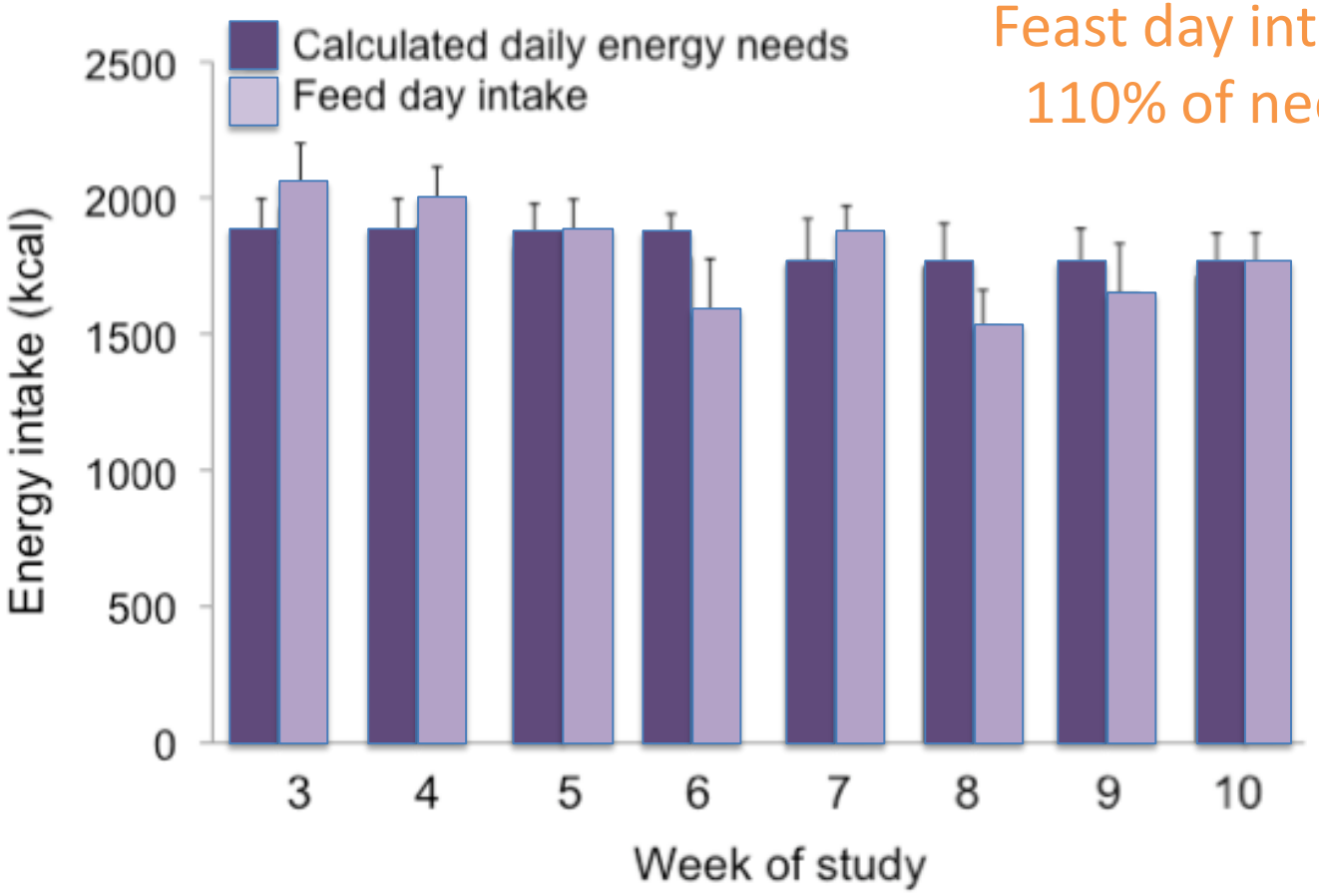
25% energy intake (500-600 kcal)
Meal consumed at lunch or dinner

How much do people eat on the feast day?



Klempel MC et al, Nutr J. 2010.

How much do people eat on the feast day?



Feast day intake:
110% of needs

Klempel MC et al, Nutr J. 2010.

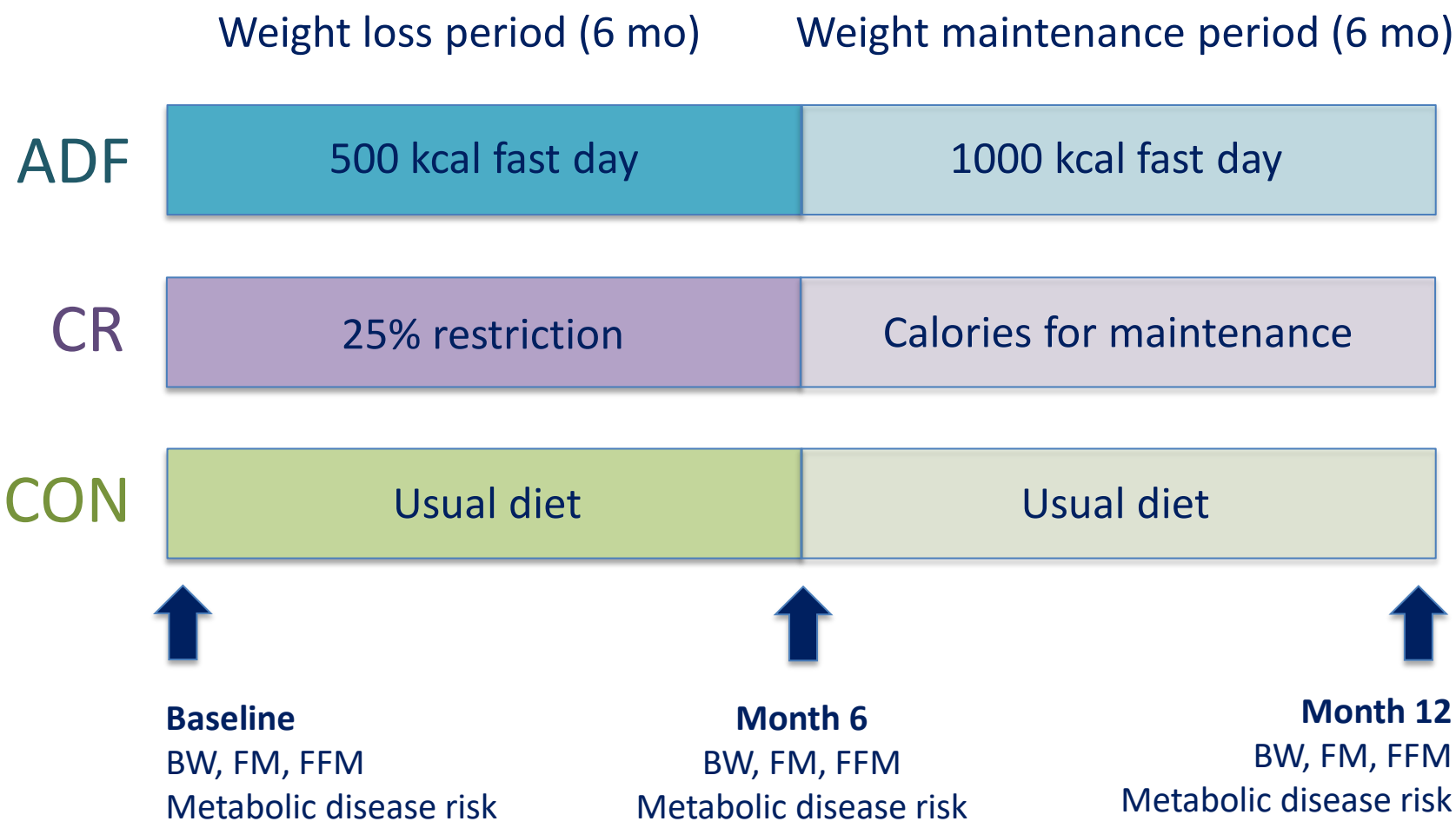
Inability to overeat on the feast day =

Inability to overeat on the feast day =

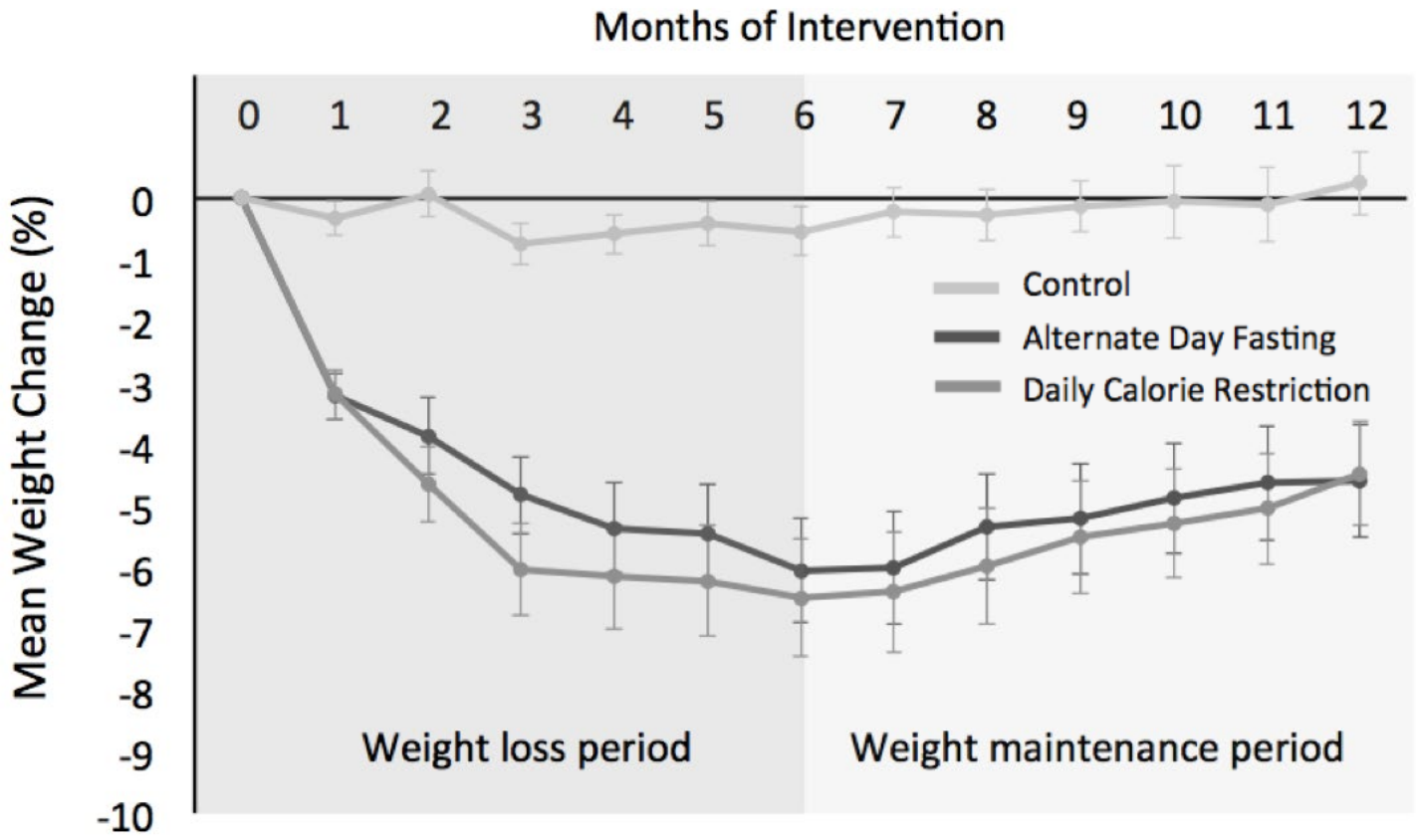
Weight loss

Is fasting better for weight loss vs. daily calorie restriction?

Experimental design – ADF vs CR study



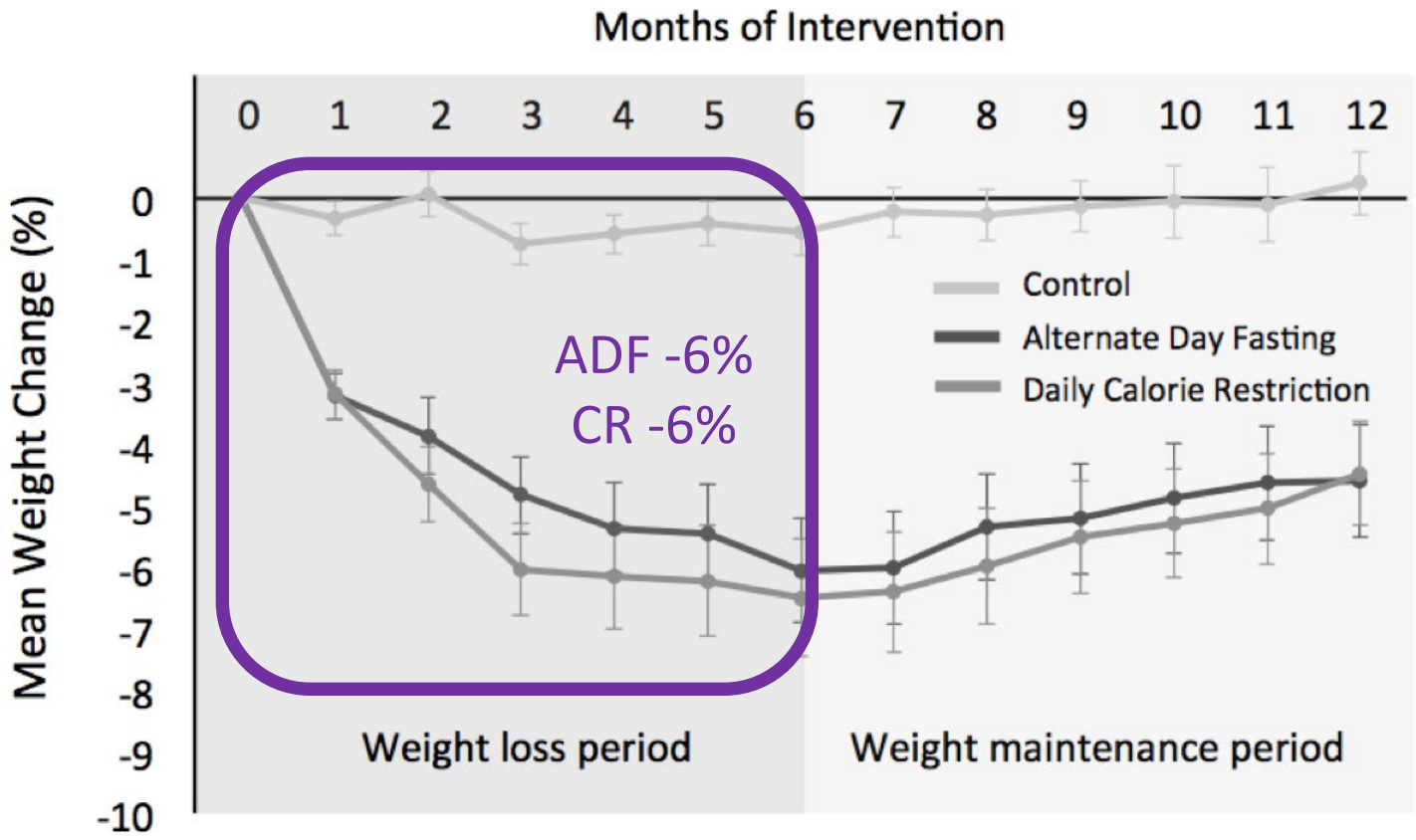
ADF and CR produced similar weight loss after 1 year



Data were included for 100 participants; means were estimated using an intention-to-treat analysis using a linear mixed model.

Trepanowski JF, 2017. JAMA IM.

ADF and CR produced similar weight loss after 1 year



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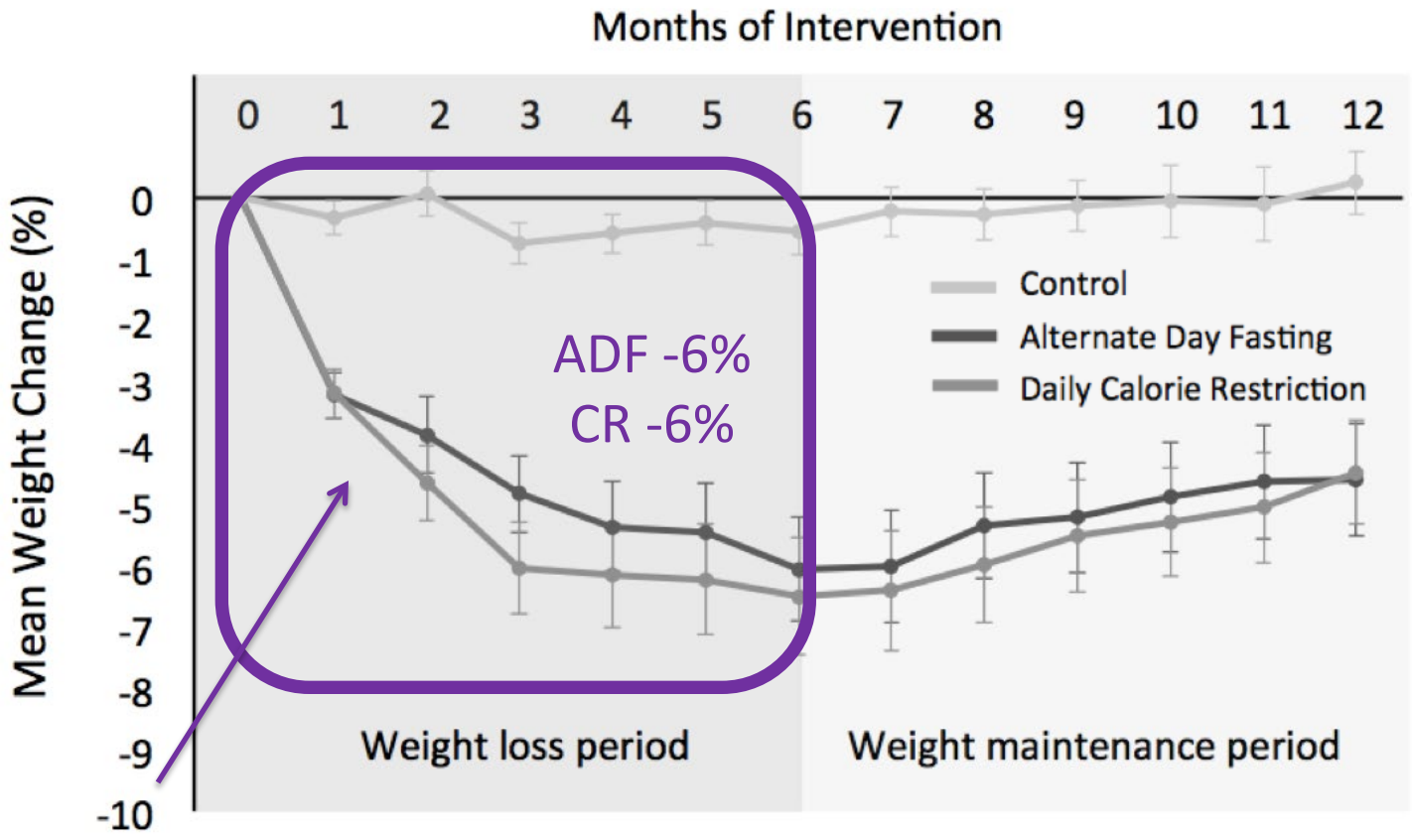
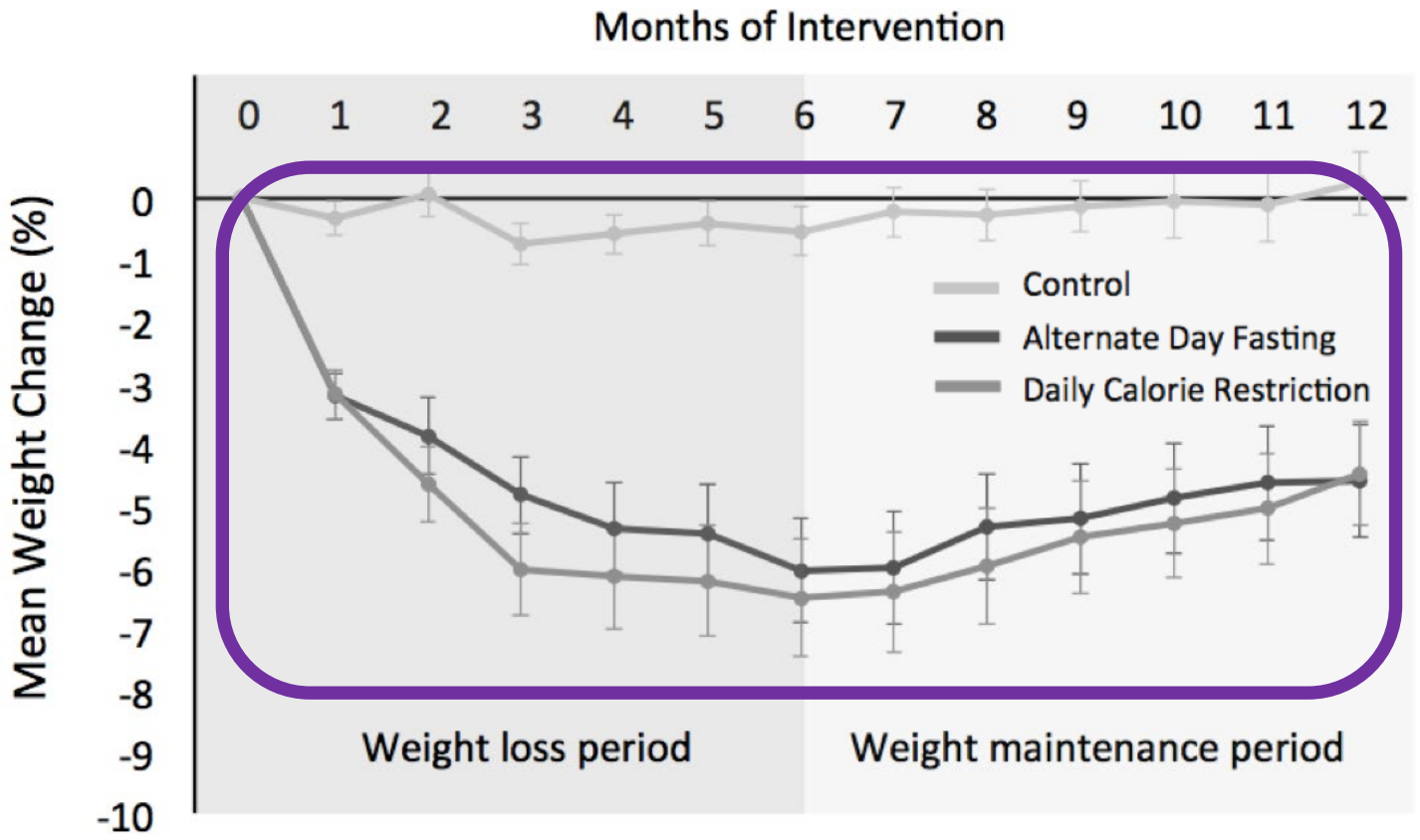


Most weight loss occurred in first 3 months

Data were included for 100 participants; means were estimated using an intention-to-treat analysis using a linear mixed model.

Trepanowski JF, 2017. JAMA IM.

ADF and CR produced similar weight loss after 1 year

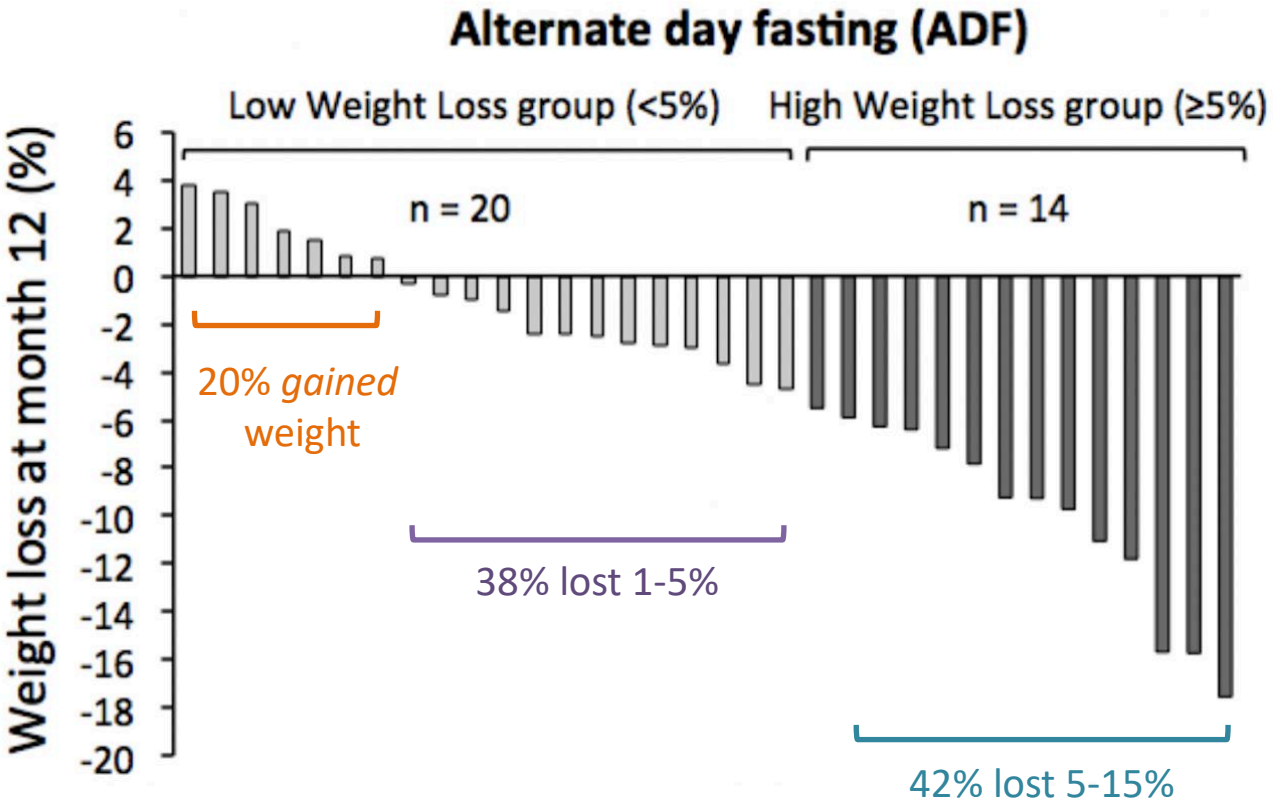


ADF -5%
CR -5%

Data were included for 100 participants; means were estimated using an intention-to-treat analysis using a linear mixed model.

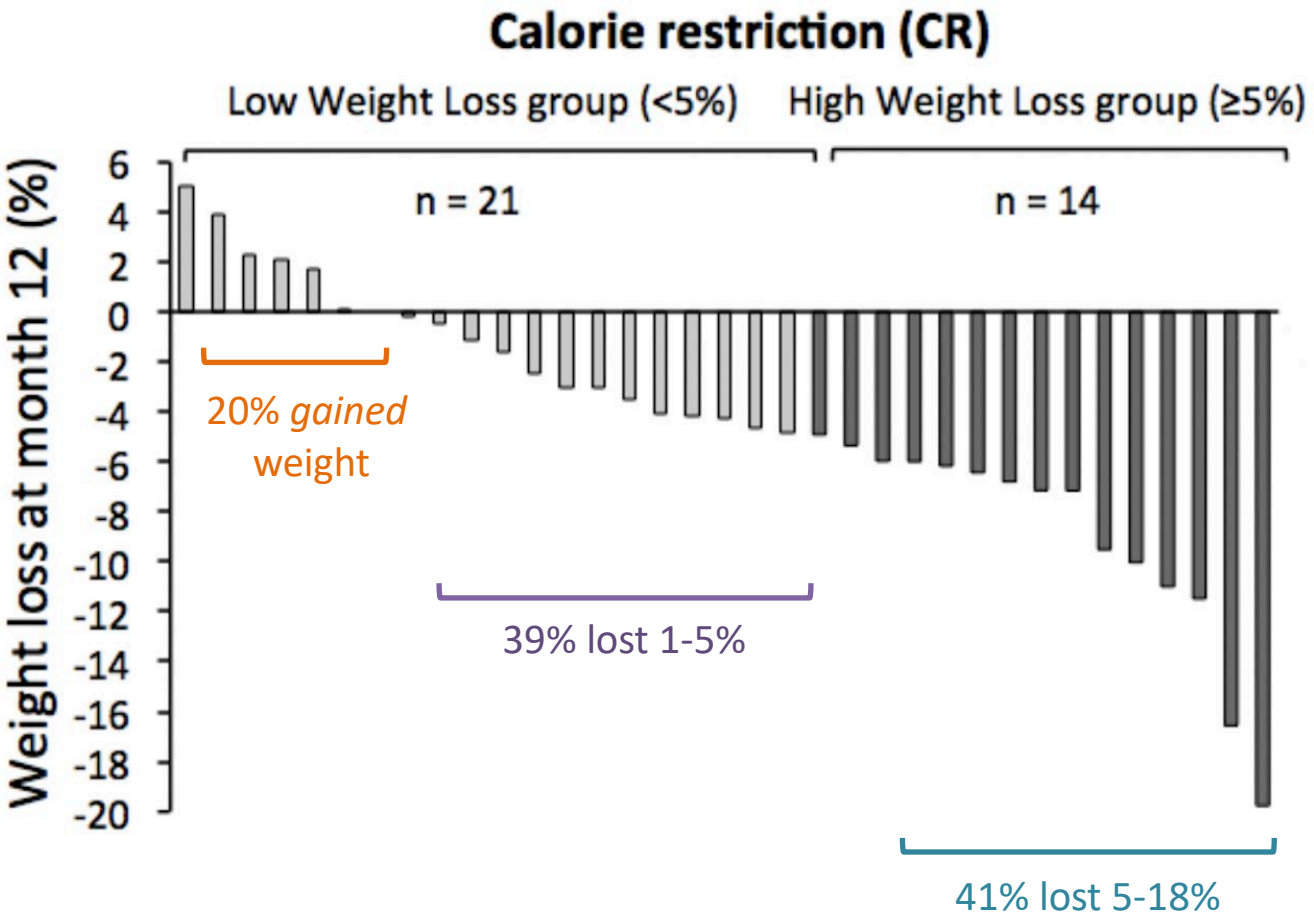
Trepanowski JF, 2017. JAMA IM.

But not everyone loses weight with fasting…



Trepanowski JF, 2017. JAMA IM.

…Which is very similar to daily calorie restriction



Trepanowski JF, 2017. JAMA IM.

12 months of ADF vs. CR in healthy adults with obesity

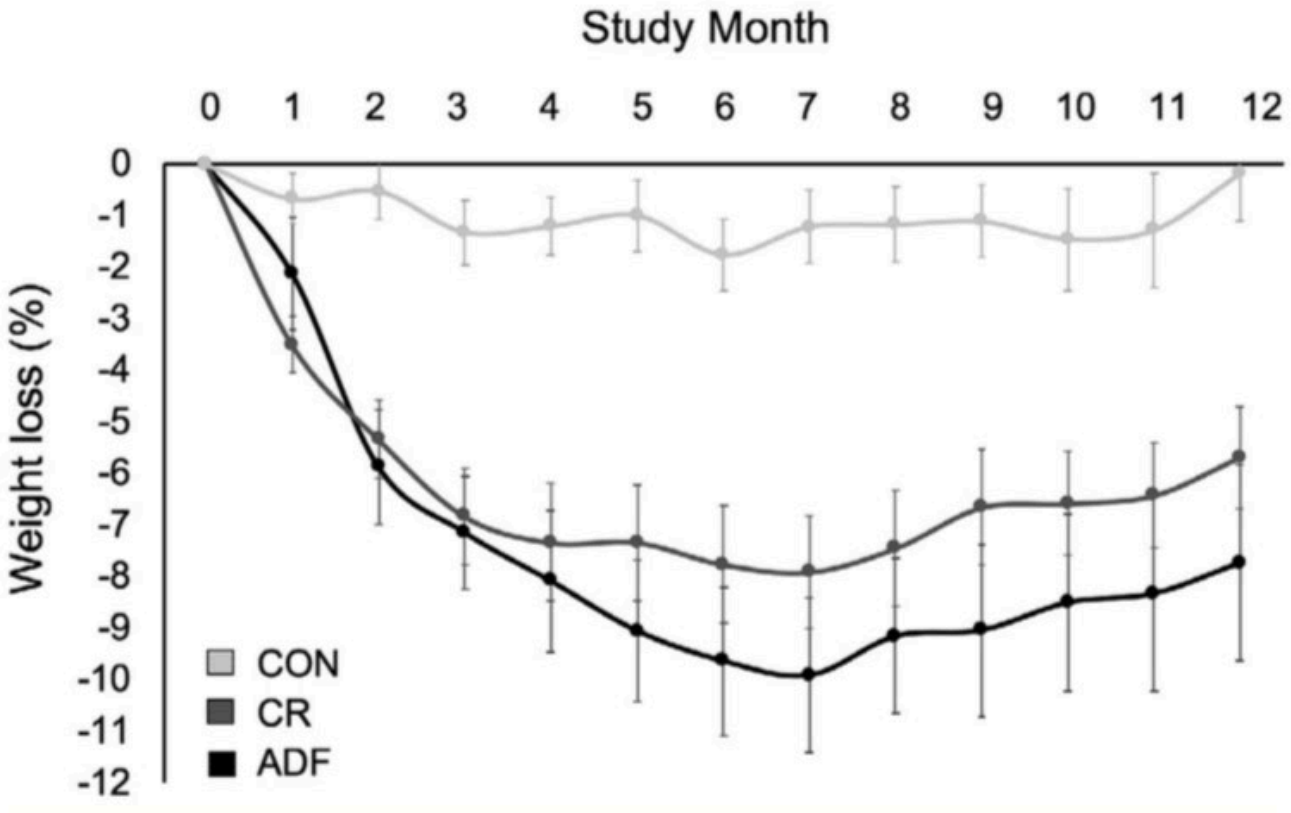
	ADF	CR
Body weight	↓ -5%	↓ -5%
Blood pressure	X	X
Heart rate	X	X
Lipids	↓ TG	↓ LDL
Glucose	X	↓
Insulin	X	X
HOMA-IR	X	X

Trepanowski JF, 2017. JAMA IM.

BUT! ADF may be more effective than CR

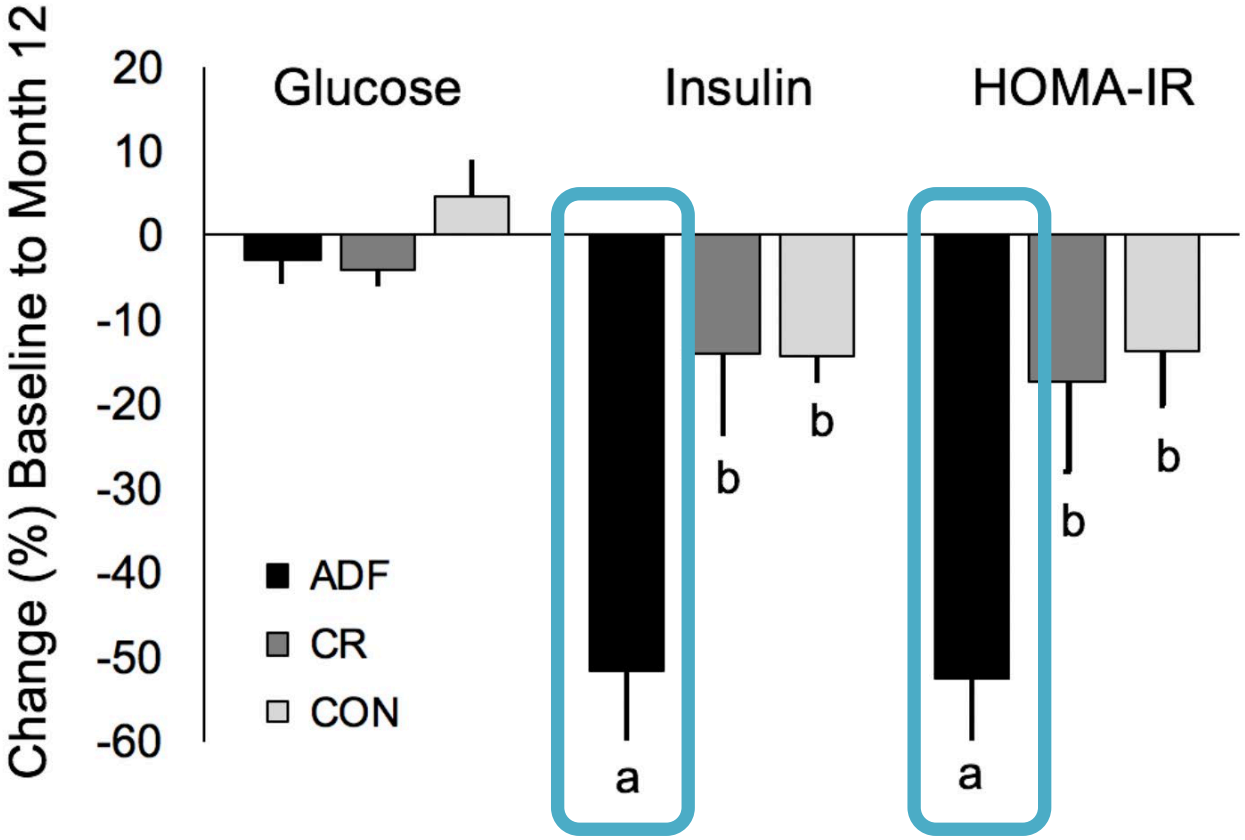
in subjects with obesity and insulin resistance

Weight loss was similar by ADF and CR in subjects with insulin resistance



Gabel K, 2019. Obesity.

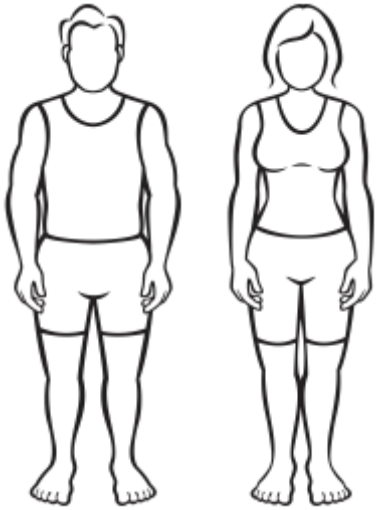
ADF produced greater reductions in insulin resistance, versus CR, in subjects with insulin resistance



Gabel K, 2019. Obesity.

Practical considerations

Who should not do intermittent fasting?

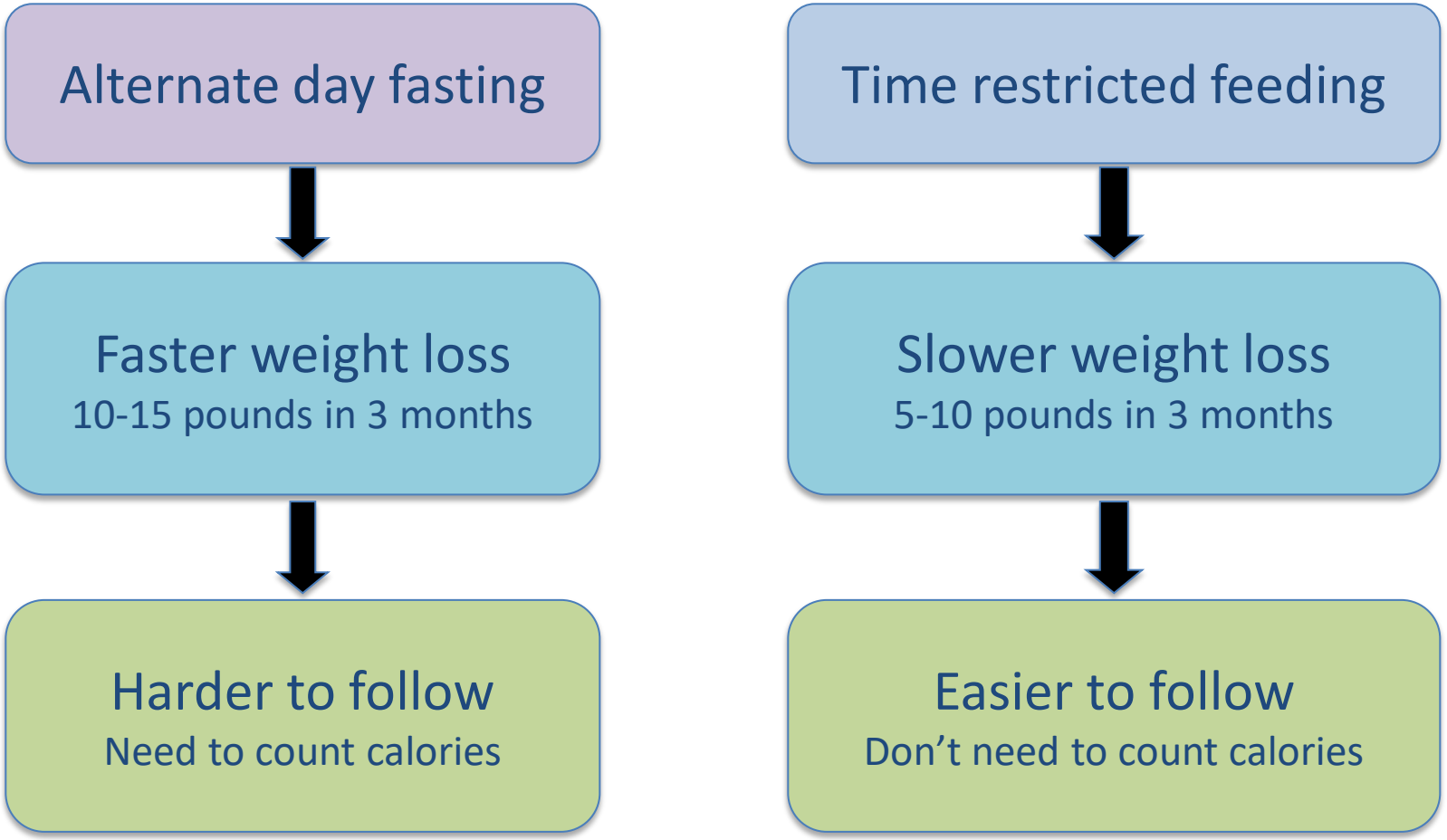


- Pregnant women
- People with binge eating disorders
- Shift workers
- Frequent snackers

Advice when starting intermittent fasting…

- First 10 days are rough
- Most common complaint: headaches
- Eventually you feel boost of energy on fast days
- Eat 50 g protein on fast day – keep hunger low

Which diet should I choose?



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