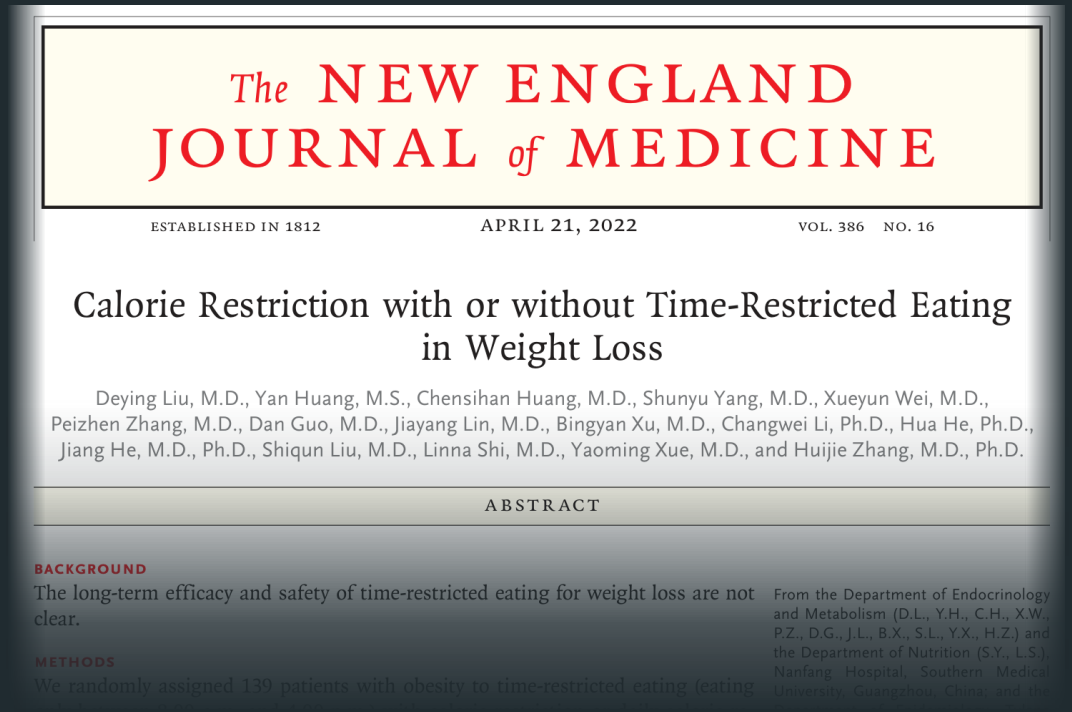
Calorie Restriction with or without Time-Restricted Eating in Weight Loss

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Jan Niemi, Maiju Rossi & Hans Vilu



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Calorie Restriction with or without Time-Restricted Eating in Weight Loss

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ABSTRACT

BACKGROUND

The long-term efficacy and safety of time-restricted eating for weight loss are not clear.

METHODS

We randomly assigned 139 patients with obesity to time-restricted eating (eating

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General Information about the Article & Journal

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Journal Profile

The New England Journal of Medicine (NEJM), published by the Massachusetts Medical Society

High-impact clinical medicine research, primarily publishing definitive, practice-changing randomized controlled trials (RCTs), major observational studies, and clinical reviews.

Traditional subscription-based model for readers, no APC for research

Journal Metrics and Leadership

JIF 158.5 in 2022, currently 84.5

Led by Editor-in-Chief Eric J. Rubin (M.D., Ph.D.) alongside other editors

Authors, Collaboration & Citation Metrics

Authors & Affiliations

Deying Liu, Yan Huang, Chensihan Huang, Shunyu Yang, Xueyun Wei, et al. as the lead authors

Multi-institutional collaboration between Nanfang Hospital (China), Southern Medical University (China), and Tulane University (USA)

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Article Citation Impact

Google Scholar: ~ 700

Scopus: ~ 500

Abstract Structure & Content

BACKGROUND

Long-term efficacy and safety of time-restricted eating (TRE) for weight loss are unclear.

METHODS

12-month RCT of 139 patients with obesity comparing 8-hour TRE (8:00 a.m.–4:00 p.m.) + calorie restriction vs. DCR alone.

RESULTS

118 participants completed the study; mean weight loss was -8.0 kg (TRE) vs. -6.3 kg (DCR) with no significant between-group difference.

CONCLUSIONS

8-hour TRE was not more beneficial than DCR alone with regard to reduction in body weight, body fat, or metabolic risk factors.

Introduction: Background, Knowledge Gap & Study Aim

Background:

Obesity is a major global public health challenge; daily calorie restriction is the standard primary weight-loss strategy.

Most dietary trials show modest long-term weight loss (<5%), making alternative interventions a priority.

Knowledge Gap:

Previous TRE pilot studies were short-term, small-scale, or lacked uniform caloric restriction controls.

Long-term efficacy, safety, and direct comparative efficacy against daily calorie restriction alone remained unknown.

Study Aim:

To conduct a randomized clinical trial assessing time-restricted eating with calorie restriction compared with daily calorie restriction alone for effects on weight loss and metabolic risk factors in patients with obesity.

Does restricting eating time improve weight loss?

139 adults with obesity

69

Time-restricted eating

08:00–16:00

70

Daily calorie restriction

Eat any time

Both groups followed a calorie-restricted diet for 12 months

Patient Recruitment and Eligibility

Recruitment

Public advertisements, online announcements and community screenings in Guangzhou, China

Inclusion Criteria

Adults aged 18–75 years

BMI of 28–45 kg/m^2

Main Exclusion Criteria

Diabetes or serious cardiovascular disease

Severe liver or kidney disease, cancer

Current smoking or medications affecting body weight

Current or planned pregnancy

139 eligible participants randomized into two groups

The two groups were comparable at baseline

Baseline measure	n = 69	n = 70
Mean age	31.6 years	32.2 years
Mean body weight	88.4 kg	87.9 kg
Mean BMI	31.8	31.3
Male participants	52.2%	50.0%

Table 1. Characteristics of the Participants at Baseline.*

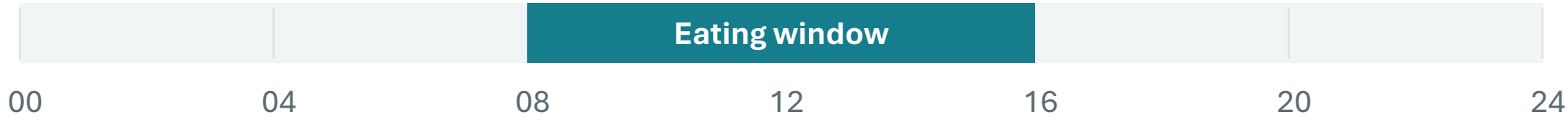
Variables	Time-Restricted Eating (N = 69)	Daily Calorie Restriction (N = 70)
Male sex — no. (%)	36 (52.2)	35 (50.0)
Age — yr	31.6±9.3	32.2±8.8
Body weight — kg	88.4±10.2	87.9±12.8
Body-mass index	31.8±2.9	31.3±2.6
Body fat mass — kg	33.0±7.3	33.2±6.3
Body lean mass — kg	51.2±7.8	50.9±9.1
Body fat — %	38.3±5.5	38.4±5.3
Waist circumference — cm	99.4±7.8	99.2±9.1
Median (IQR) abdominal fat area — cm^2		
Visceral	122.3 (97.2–159.7)	124.9 (91.4–160.0)
Subcutaneous	312.8 (264.5–386.3)	302.9 (248.0–360.4)
Blood pressure — mm Hg		
Systolic	125.3±12.0	124.8±12.2
Diastolic	73.1±9.5	74.5±9.6
Pulse — beats/min	78.6±11.7	79.1 ±10.3

Table 1. Characteristics of the Participants at Baseline.*

Variables	Time-Restricted Eating (N = 69)	Daily Calorie Restriction (N = 70)
Glucose — mg/dl	90.9±11.0	92.1±17.1
Glycated hemoglobin — %	5.3±0.4	5.4±0.8
Median (IQR) HOMA–IR index value†	3.4 (2.4–5.1)	3.3 (2.0–4.4)
Cholesterol — mg/dl		
Total	194.5±32.9	198.0±37.8
High-density lipoprotein	46.1±10.2	45.1±12.7
Low-density lipoprotein	130.7±29.9	129.6±33.7
Median (IQR) triglycerides — mg/dl	130.2 (86.8–173.7)	137.3 (107.2–185.2)
Dyslipidemia — no. (%)	48 (69.6)	53 (75.7)
Hypertension — no. (%)	11 (15.9)	12 (17.1)
Total caloric intake — kcal/day	2052.5±341.7	2075.7±391.5
Daily eating window — hr:min	10:23±01:25	10:24±01:34
Median (IQR) physical activity — METs per wk	12.0 (8.3–23.6)	15.0 (8.0–23.1)
SF-12 score‡		
Physical component summary	45.3±7.1	46.4±6.6
Mental component summary	53.2 ±7.1	53.2±6.9

Both groups had same calorie targets.

Time Restricted Eating Group: 08:00 to 16:00



Daily Calorie Restricted Group: flexible timing



Men 1,500–1,800 kcal/day **Women 1,200–1,500 kcal/day**

How was the trial monitored?



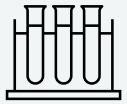
Food intake

Logs, photographs and recorded meal times. Protein shakes supplies for 6 months.



Follow-up

Health coaches throughout the 12 months



Measurements

Weight, DXA, CT, blood pressure and laboratory tests

Primary outcome: difference in body-weight change at 12 months

Dietary Monitoring and Support

	Months 1–6	Months 7–12
Food diaries and meal photos	**Daily**	**3 days/week**
Eating-time records	**Daily**	**3 days/week**
Calls and app messages	**Twice weekly**	**Weekly**
Individual health coaching	**Every 2 weeks**	**Monthly**
Protein shake provided	**1 per day**	**Not provided**
Health education sessions	**Monthly**	**Monthly**

Both groups continued the same calorie targets throughout the study.

Retention and adherence were good

139	135	118
randomized	at 6 months	at 12 months

Days meeting the prescribed diet

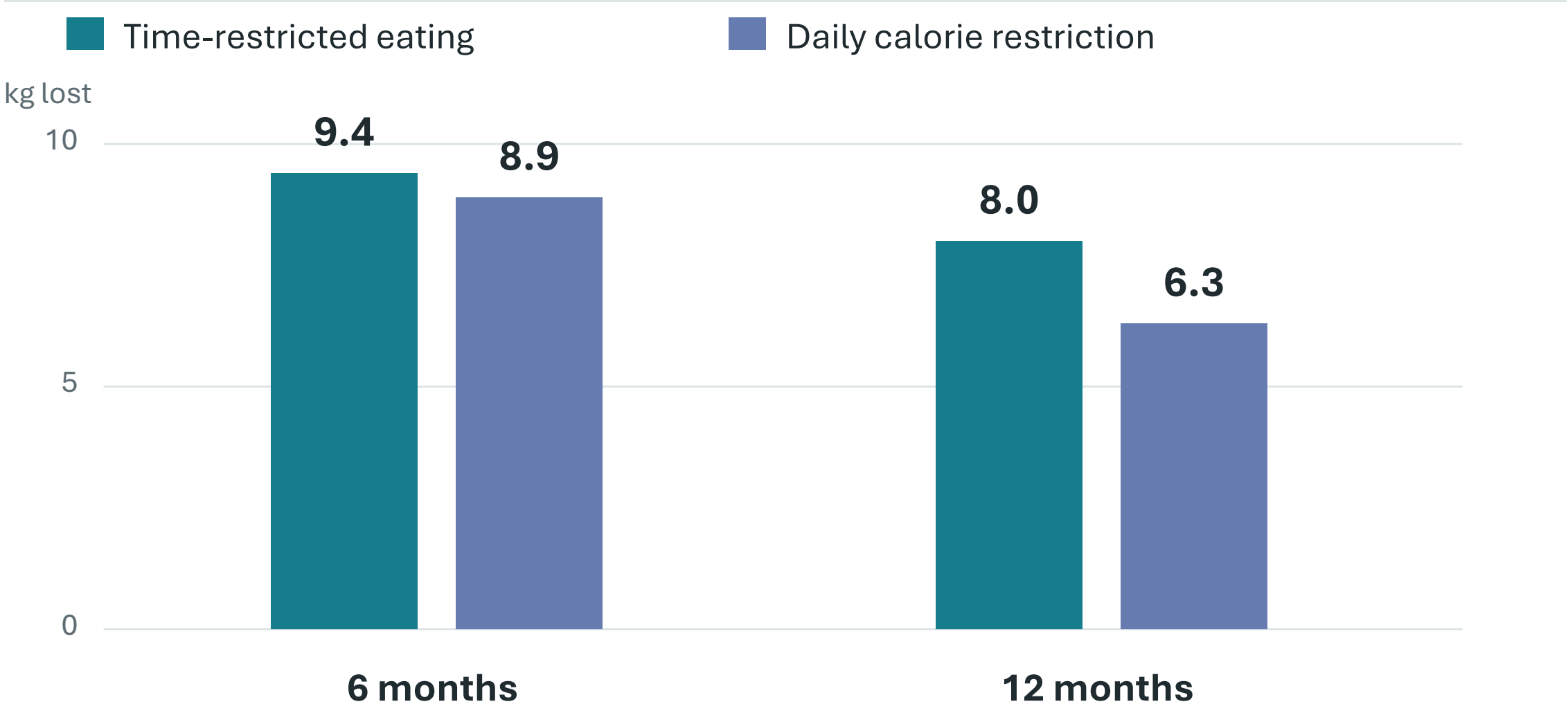
84.0%
Time Restricted

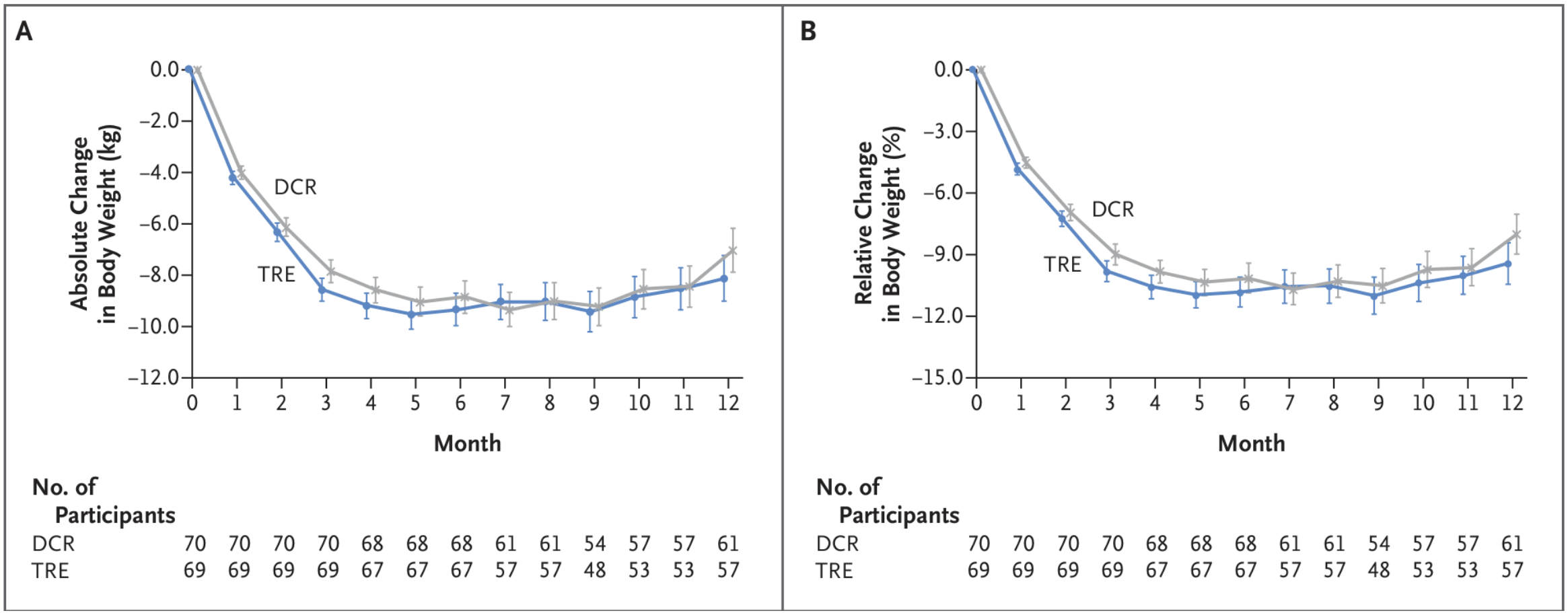


83.8%
Calorie Restricted

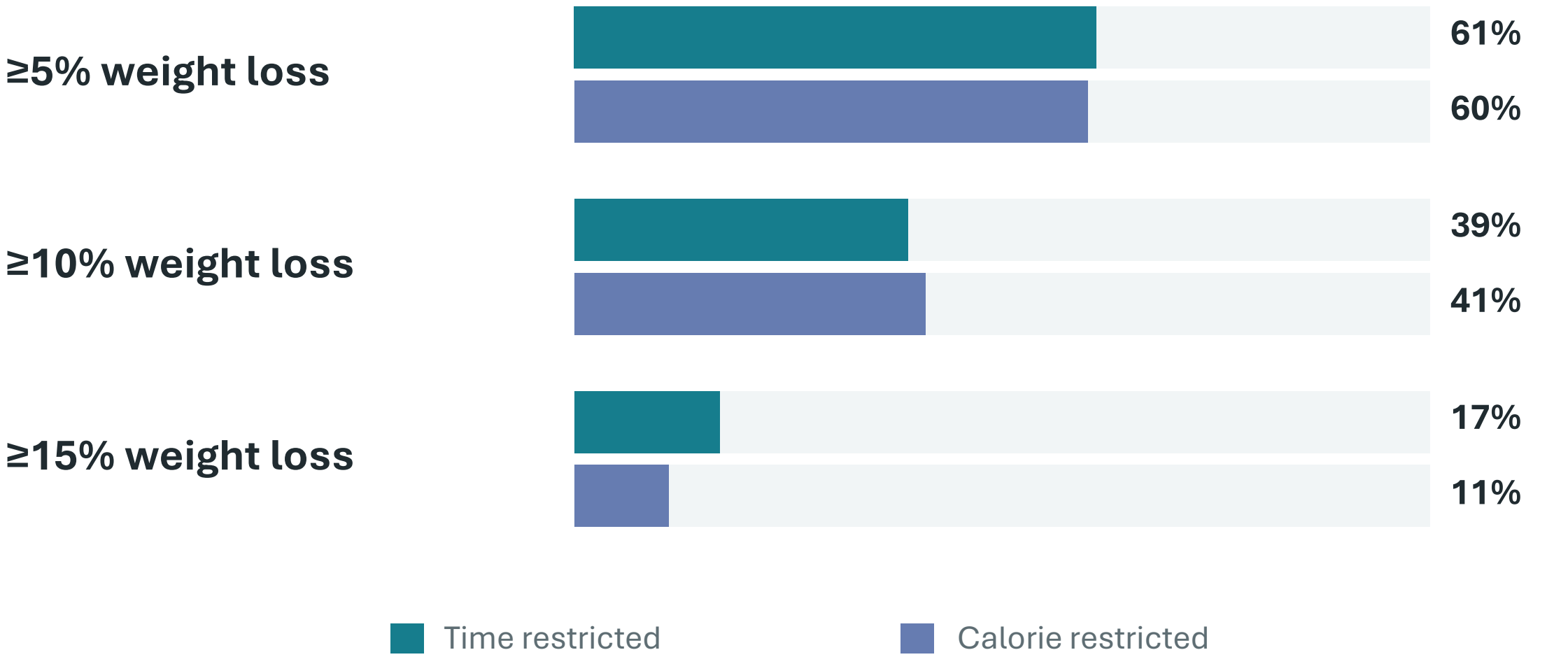


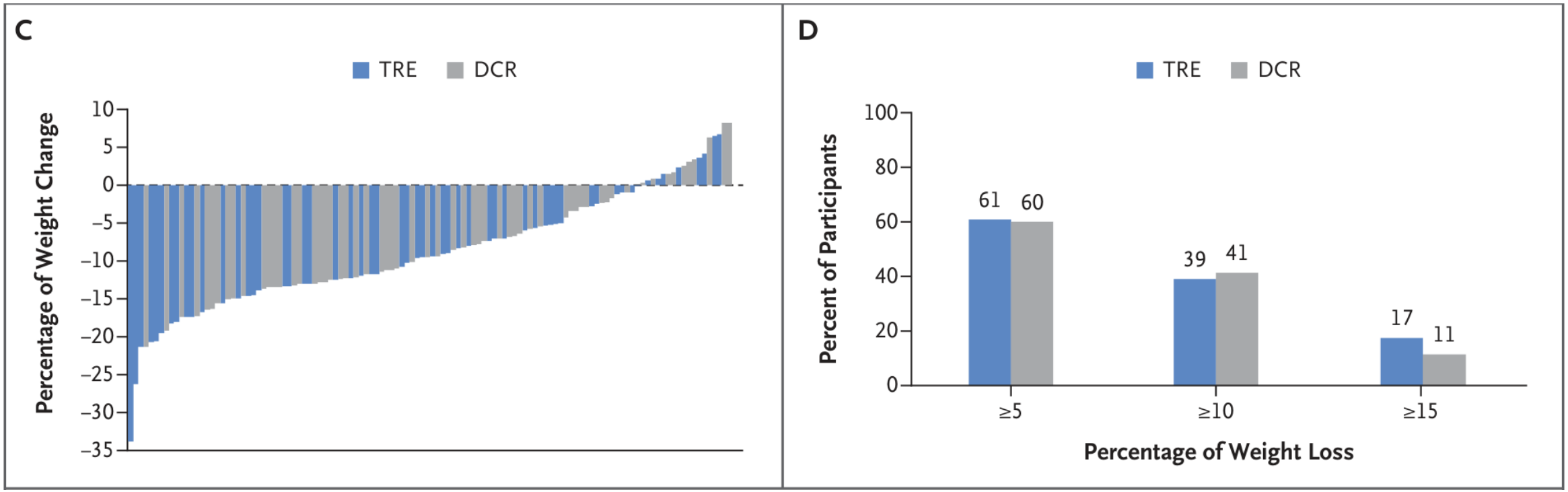
Both groups lost substantial weight




A
Absolute Change in Body Weight (kg)
0.0
−2.0
−4.0
−6.0
−8.0
−10.0
−12.0
DCR
TRE
0 1 2 3 4 5 6 7 8 9 10 11 12
Month
No. of Participants
DCR 70 70 70 70 68 68 68 61 61 54 57 57 61
TRE 69 69 69 69 67 67 67 57 57 48 53 53 57
B
Relative Change in Body Weight (%)
0.0
−3.0
−6.0
−9.0
−12.0
−15.0
DCR
TRE
0 1 2 3 4 5 6 7 8 9 10 11 12
Month
No. of Participants
DCR 70 70 70 70 68 68 68 61 61 54 57 57 61
TRE 69 69 69 69 67 67 67 57 57 48 53 53 57

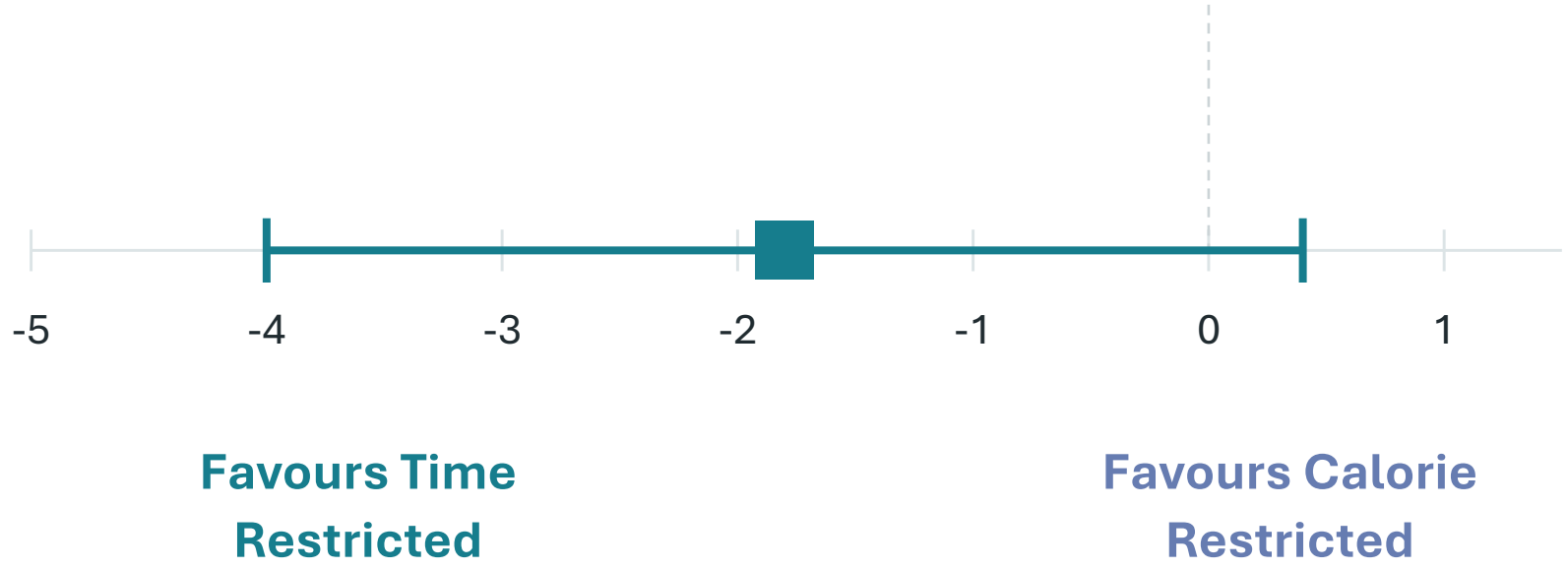
Clinically meaningful weight loss was common




C
TRE
DCR
Percentage of Weight Change
10
5
0
−5
−10
−15
−20
−25
−30
−35
D
TRE
DCR
Percent of Participants
100
80
60
40
20
0
61
60
39
41
17
11
≥5
≥10
≥15
Percentage of Weight Loss

The additional benefit was not established

Difference in 12-month weight change: TRE minus DCR



−1.8 kg

95% CI

−4.0 to +0.4

p = 0.11

Fat was lost, but some lean mass was lost too

Change after 12 months	Time restricted	Calorie restricted
Body fat mass	**−5.9 kg**	**−4.5 kg**
Lean mass	**−1.7 kg**	**−1.4 kg**
Waist circumference	**−8.8 cm**	**−7.0 cm**
Visceral fat area	**−26.0 cm^2**	**−21.1 cm^2**

No reliable between-group difference in body composition

Table 2. Effects of Diets on Weight Loss and Body Composition.*

Variable	Time-Restricted Eating (N = 69)	Daily Calorie Restriction (N = 70)	Difference between Groups (95% CI)
	Change from baseline (95% CI)		
Body weight — kg			
6 mo	−9.4 (−10.8 to −7.9)	−8.9 (−10.3 to −7.4)	−0.5 (−2.6 to 1.6)
12 mo	−8.0 (−9.6 to −6.4)	−6.3 (−7.8 to −4.7)	−1.8 (−4.0 to 0.4)
Body-mass index			
6 mo	−3.4 (−3.9 to −2.9)	−3.2 (−3.7 to −2.7)	−0.2 (−1.0 to 0.5)
12 mo	−2.9 (−3.5 to −2.3)	−2.3 (−2.8 to −1.7)	−0.7 (−1.5 to 0.1)
Waist circumference — cm			
6 mo	−9.4 (−11.0 to −7.9)	−8.7 (−10.2 to −7.3)	−0.7 (−2.8 to 1.4)
12 mo	−8.8 (−10.4 to −7.1)	−7.0 (−8.5 to −5.4)	−1.8 (−4.0 to 0.5)
Body fat mass — kg			
6 mo	−6.9 (−8.0 to −5.7)	−6.4 (−7.5 to −5.3)	−0.5 (−2.0 to 1.1)
12 mo	−5.9 (−7.1 to −4.7)	−4.5 (−5.6 to −3.3)	−1.5 (−3.1 to 0.2)

Table 2. Effects of Diets on Weight Loss and Body Composition.*

Variable	Time-Restricted Eating (N = 69)	Daily Calorie Restriction (N = 70)	Difference between Groups (95% CI)
	Change from baseline (95% CI)		
Body lean mass — kg			
6 mo	−1.9 (−2.4 to −1.4)	−1.7 (−2.2 to −1.2)	−0.2 (−0.9 to 0.5)
12 mo	−1.7 (−2.3 to −1.1)	−1.4 (−2.0 to −0.9)	−0.3 (−1.1 to 0.5)
Body fat percent — %			
6 mo	−4.7 (−5.6 to −3.8)	−4.4 (−5.3 to −3.5)	−0.3 (−1.6 to 1.0)
12 mo	−4.3 (−5.3 to −3.3)	−3.0 (−3.9 to −2.0)	−1.3 (−2.7 to 0.1)
Area of abdominal visceral fat — cm^2			
6 mo	−32.9 (−41.1 to -24.8)	−31.3 (−39.2 to −23.4)	−1.7 (−13.0 to 9.7)
12 mo	−26.0 (−35.0 to −17.1)	−21.1 (−29.5 to −12.8)	−4.9 (−17.3 to 7.5)
Area of abdominal subcutaneous fat — cm^2			
6 mo	−70.1 (−85.2 to −55.1)	−49.2 (−64.1 to −34.4)	−20.9 (−42.0 to 0.2)
12 mo	−53.2 (−71.9 to −34.6)	−37.0 (−52.1 to −21.9)	−16.2 (−39.2 to 6.8)

Metabolic improvements were similar

12-month change	Time restricted	Calorie restricted
Systolic blood pressure	**−8.1 mmHg**	**−7.7 mmHg**
Triglycerides	**−25.5 mg/dL**	**−19.6 mg/dL**
Fasting glucose	**−3.5 mg/dL**	**−3.0 mg/dL**
HOMA-IR	**−1.0**	**−0.5**

Table 3. Changes in Cardiovascular Risk Factors during 12-Month Trial Period.*

Variable	Time-Restricted Eating (N = 69)	Daily Calorie Restriction (N = 70)	Difference between Groups (95% CI)
	Change from baseline (95% CI)		
Systolic blood pressure — mm Hg			
6 mo	−10.1 (−12.4 to −7.8)	−8.1 (−10.3 to −5.9)	−1.9 (−5.1 to 1.2)
12 mo	−8.1 (−10.4 to −5.7)	−7.7 (−10.1 to −5.4)	−0.3 (−3.7 to 3.1)
Diastolic blood pressure — mm Hg			
6 mo	−6.0 (−7.8 to −4.2)	−5.1 (−6.8 to −3.3)	−0.9 (−3.4 to 1.6)
12 mo	−5.1 (−7.1 to −3.1)	−3.8 (−5.7 to −2.0)	−1.3 (−4.1 to 1.6)
Pulse — beats/min			
6 mo	−3.1 (−5.4 to −0.9)	−2.4 (−4.5 to −0.2)	−0.8 (−3.9 to 2.4)
12 mo	−1.6 (−4.0 to 0.8)	−1.9 (−4.1 to 0.3)	0.3 (−2.9 to 3.5)
Triglycerides — mg/dl			
6 mo	−44.8 (−60.0 to −29.5)	−31.7 (−46.6 to −16.8)	−13.1 (−34.6 to 8.4)
12 mo	−25.5 (−42.2 to −8.8)	−19.6 (−35.9 to −3.4)	−5.9 (−28.5 to 16.8)
Total cholesterol — mg/dl			
6 mo	−9.0 (−15.9 to −2.2)	−13.7 (−20.2 to −7.2)	4.7 (−4.8 to 14.1)
12 mo	−7.3 (−14.3 to −0.3)	−9.3 (−15.9 to −2.6)	1.9 (−7.9 to 11.7)

Table 3. Changes in Cardiovascular Risk Factors during 12-Month Trial Period.*

Variable	Time-Restricted Eating (N = 69)	Daily Calorie Restriction (N = 70)	Difference between Groups (95% CI)
	Change from baseline (95% CI)		
High-density lipoprotein cholesterol — mg/dl			
6 mo	4.2 (2.4 to 6.1)	2.7 (0.9 to 4.4)	1.6 (–1.0 to 4.1)
12 mo	4.6 (2.6 to 6.5)	2.9 (1.1 to 4.8)	1.6 (–1.1 to 4.3)
Low-density lipoprotein cholesterol — mg/dl			
6 mo	–5.9 (–12.0 to 0.1)	–11.3 (–17.1 to –5.6)	5.4 (–2.9 to 13.7)
12 mo	–8.4 (–14.7 to –2.1)	–8.9 (–15.1 to –2.8)	0.5 (–8.5 to 9.5)
Glucose level — mg/dl			
6 mo	–5.0 (–8.5 to –1.6)	–4.1 (–7.4 to –0.7)	–1.0 (–5.8 to 3.8)
12 mo	–3.5 (–7.6 to 0.5)	–3.0 (–6.7 to 0.7)	–0.6 (–6.1 to 4.9)
2-hour postprandial glucose — mg/dl			
6 mo	–15.4 (–23.7 to –7.1)	–10.6 (–18.6 to –2.6)	–4.8 (–16.3 to 6.6)
12 mo	–10.8 (–19.7 to –2.0)	–12.1 (–20.2 to –3.9)	1.3 (–10.8 to 13.3)
HOMA–IR index value			
6 mo	–1.4 (–1.9 to –0.8)	–1.2 (–1.8 to –0.6)	–0.2 (–1.0 to 0.6)
12 mo	–1.0 (–1.7 to –0.4)	–0.5 (–1.1 to 0.1)	–0.5 (–1.4 to 0.4)
Insulin disposition index†			
6 mo	–4.6 (–11.4 to 2.2)	–3.3 (–10.0 to 3.5)	–1.3 (–10.9 to 8.2)
12 mo	–6.7 (–18.5 to 5.1)	0.6 (–8.6 to 9.8)	–7.3 (–20.8 to 6.2)

No serious effects

0

Deaths or serious adverse events

Mild effects

Similar in both groups

Fatigue, headache, dizziness
Digestive symptoms

Can’t rule out long-term harm

What did the study not test?

It tested

Does an 08:00–16:00 window add benefit when calories are also restricted?

It did not test

Fasting versus no diet

Every fasting schedule

Long-term disease prevention

Study limitations

Strengths

- Random assignment
- 12-month follow-up
- Similar calorie targets
- DXA and CT measurements

Limitations

- Single-region, selected cohort
- Self-recorded dietary intake
- No objective energy expenditure
- Only one eating window tested

Study summary

139 adults · same calorie targets

TRE

08:00–16:00

–8.0 kg

DCR

Flexible eating time

–6.3 kg

No statistically significant additional benefit of TRE

What should we take away (and ask next)?

01 If results are non-significant, can the diets still differ?

02 Would a later eating window or less coaching change the results?

03 Which patients might benefit most from one approach?

Thank you