Evaluating the Impact of Intermittent Fasting on Anthropometric, Cardiovascular, and Metabolic Outcomes: A Targeted Literature Review

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INTRODUCTION

- Intermittent fasting (IF) is characterised by alternating periods of fasting and unrestricted eating. It has emerged as a dietary approach for managing chronic conditions. Among the most extensively researched types of IF are alternate-day fasting (ADF), the 5:2 diet, and the time-restricted eating[1]
- ADF involves alternating between a fast day, during which individuals consume 25% of their usual intake (about 500 kcal), and a feast day, where they are allowed to eat freely[2]
- This targeted literature review evaluated the impact of IF (particularly ADF) on anthropometric, cardiovascular, and metabolic health outcomes in healthy (lean, non-obese, or obese) individuals

METHODS

- PubMed, US trials registry, WHO trial registry, and Google Scholar were searched from 2000 up to 15 June 2024

Inclusion Criteria

- Healthy adults (lean, non-obese, or obese)
- ADF as an intervention
- Randomised controlled trials (RCTs)

Exclusion Criteria

- Participants with any disorders/diseases other than obesity
- Modified ADF or ADF with any dietary/energy restrictions
- Animal/in vitro studies

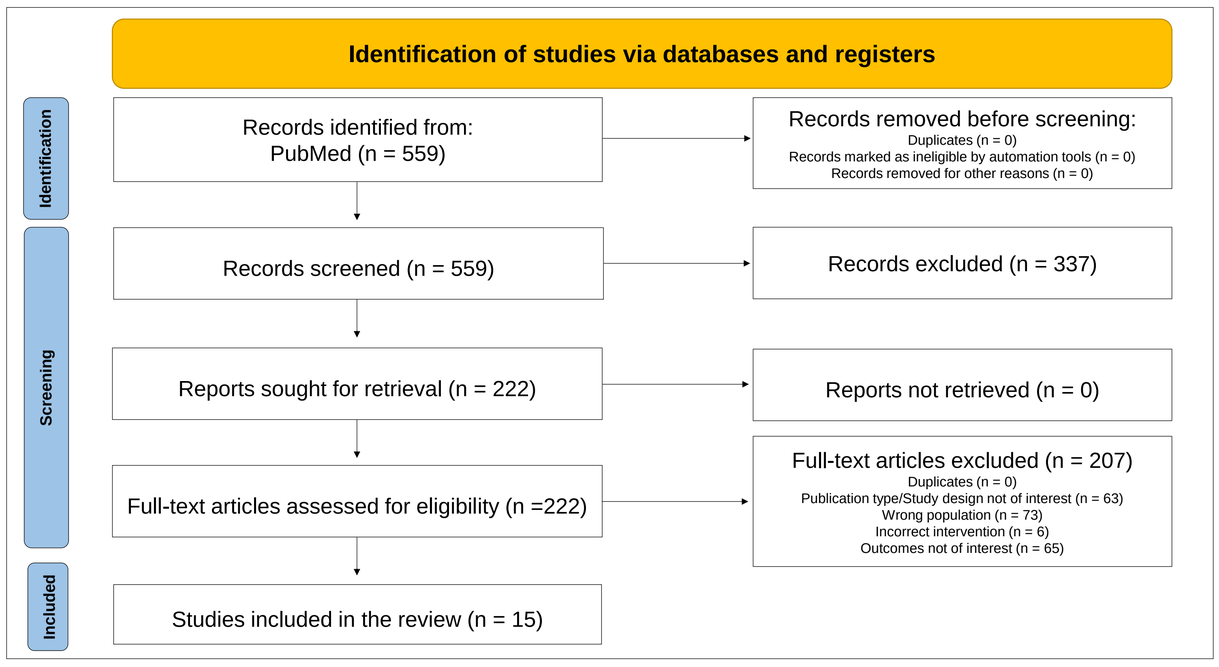
Outcomes

- Anthropometric, cardiovascular, and metabolic health outcomes

RESULTS

- Fifteen RCTs with 287 participants were included in the review (**Figure 1**)[2-16]
- The characteristics of the RCTs included in the review are presented in **Table 1**
- Nine[3-11] of the 15 studies were published after 2014, which implies that IF has been in trend over the past decade

Figure 1. PRISMA flow diagram depicting study selection and inclusion process



Abbreviations: PRISMA, Preferred reporting items for systematic reviews and meta-analyses.

Anthropometric Outcomes

- Body weight reduction was generally observed across trials; however, three trials reported an increase (**Table 2**)
- Body mass index, fat mass, lean mass, visceral fat, and waist circumference were reduced across the trials
- Fat free mass decreased in four trials, while one trial reported no change from baseline

Table 1. Characteristics of the included RCTs

Study	Sample size	Study duration	Gender, n (%)	Age (Mean)	BMI (kg/m^2)
Herz, et al., 2024[3]	8	8 weeks	NR	25.4 ± 2.1[b]	24.7 ± 2.4[b]
Zimmermann et al., 2023[4]	8	8 weeks	Female: 4 (50)	25.3 ± 2.1[b]	25.0 ± 2.3[b]
Kalam et al., 2021[5]	31	6 months	Female: 25 (80.64)	48 ± 2[a]	38 ± 1[a]
Kalam et al., 2019[6]	31	6 months	Female: 25 (80.64)	48 ± 2[a]	38 ± 1[a]
Stekovic et al., 2019[7]	30	4 weeks	Female: 16 (53.33)	NR	25.48 (24.21 to 27.06)
Trepanowski et al., 2018[8]	25	24 week	Female: 22 (88)	46 ± 2[a]	34 ± 1[a]
Barnosky et al., 2017[9]	21	6 months	Female: 19 (90.48)	44±2[a]	34±1[a]
Harder–Lauridsen et al., 2017[10]	10	NR	NR	24.0 (1.8)[b]	NR
Catenacci et al., 2016[11]	13	32 weeks	Female: 10 (77)	39.6 (9.5)[b]	35.8 (3.7)[b]
Bhutani et al., 2013a[12]	25	12 weeks	Female: 24 (96)	42 ± 2[a]	35 ± 1[a]
Bhutani et al., 2013b[13]	25	12 weeks	Female: 24 (96)	42 ± 2[a]	35 ± 1[a]
Varady et al., 2013[14]	15	12 weeks	Female: 10 (66.66)	47 ± 3[a]	26 ± 1[a]
Varady et al., 2011[2]	13	12 weeks	Female: 3 (23.07)	47 ± 2[a]	32 ± 2[a]
Bhutani et al., 2010[15]	16	8 weeks	Female: 12 (75)	Female: 45 ± 3[a] Men: 46 ± 5[a]	Women: 33 ± 1[a] Men: 34 ± 2[a]
Heilbronn et al., 2005[16]	16	22 days	Female: 8 (50)	Men: 34 ± 3[a] Female: 30 ± 1[a]	Women: 22.6 ± 0.6[a] Men: 25.2 ± 1.1[a]

Abbreviations: ADF, Alternate day fasting; BMI, Body mass index; n, number of participants, NR, Not reported; RCT, Randomised controlled trial.
Notes: [a.] Mean ± SEM, [b.] Mean (SD).

Cardiovascular and Metabolic Outcomes

- Systolic blood pressure (BP) decreased in four trials, remained unchanged in one, and increased in one, while diastolic BP decreased in four trials and remained unchanged in two trials (**Table 2**)
- Heart rate increased in one trial, decreased in one, and remained unchanged in one trial
- Cholesterol levels decreased in three trials, increased in three, and remained unchanged in one; similarly, high-density lipoprotein (HDL) decreased in three trials, remained stable in two, and increased in one, whereas low-density lipoprotein (LDL) decreased in four trials and increased in three trials
- Triglycerides decreased in three trials, increased in two trials, and remained unchanged in one trial
- Fasting blood glucose (FBG) decreased in three trials, increased in two, and remained unchanged in one, while insulin levels decreased in four trials and increased in two trials

CONCLUSIONS

ADF showed improvements in anthropometric, cardiovascular, and metabolic outcomes, though the mixed results highlight the need for personalized approaches. Future research should explore the long-term effects of ADF on diverse populations to better understand its impact

Table 2. Anthropometric, cardiovascular, and metabolic outcomes (change from baseline)

Author	Body weight	BMI (kg/m^2)	Fat mass	Fat free mass/ *Lean mass*	Systolic BP (mmHg)	Diastolic BP (mmHg)	Heart rate (bpm)	Cholesterol	HDL	LDL	Triglycerides	FBG	Insulin
Herz, et al., 2024[3§]	**-1.9 ± 1.6 kg**	**-0.6 ± 0.5**	-0.6 ± 1.2 kg	**-1.4 ± 1.5 kg**	NR	NR	NR	22.8 ± 23.5 mg/L	2.4 ± 7.5 mg/L	25.4 ± 21.5 mg/L	-22.8 ± 40.3 mg/dL	-4.2 ± 11.5 mg/dL	NR
Zimmermann et al., 2023[4§]	NR	NR	NR	NR	NR	NR	5.6 ± NR*	NR	NR	NR	NR	NR	NR
Kalam et al., 2021[5]	**-6.2 ± 1.0 kg**	NR	**-5.0 ± 0.9 kg**	***-0.3 ± 0.3 kg***	NR	NR	NR	NR	NR	NR	NR	0.2 ± 2.0 mg/dL	**-3.3 ± 1.3 µIU/mL**
Kalam et al., 2019[6]	-6.3 ± 1.0%*	NR	NR	NR	**-7 ± 3**	**-5 ± 3**	NR	**-6 ± 2%**	NR	**8 ± 3%**	NR	NR	**-24 ± 8%**
Stekovic et al., 2019[7‡]	**-3.5 ± 1.5**	**-1.2 (-1.5, -0.9)**	**-2.1 (-3.1, -1.4) kg**	***-1.6 (-2.0, -0.7) kg***	**-4.5 (-7.8, -0.5)**	**-2.5 (-4, 1)**	**-4.5 (-6, -1)**	NR	NR	NR	NR	NR	NR
Trepanowski et al., 2018[8†]	-7.3 ± 0.9%*	NR	**-10 ± 2%**	-1.2 ± 0.4 kg	NR	NR	NR	NR	NR	NR	NR	NR	NR
Barnosky et al., 2017[7]	**-7.8 ± 1.2%**	NR	Reduced*	*Reduced**	NR	NR	NR	NR	NR	NR	NR	NR	NR
Harder–Lauridsen et al., 2017[10†]	-1.8 (-2.6, -1.0) kg*	NR	-0.2 (-0.6, 0.2) kg*	*-1.6 (2.2, 0.9) kg**	1.7 (-3.0, 6.3)*	0.0 (-4.1, 4.2)*	NR	0.1 (-0.1, 0.3) mmol/L*	-0.1 (-0.2, -0.1) mmol/L*	0.1 (-0.0, 0.3) mmol/L*	0.0 (-0.1, 0.2) mmol/L	-0.2 (-0.5, 0.1) mmol/L	**24.7% (0.3, 55.0)**
Catenacci et al., 2016[11§]	**-5.7 (1.5) kg**	**-2.2 (0.5)**	**-4.2 (1.0) kg**	***-1.2 (0.6) kg***	NR	NR	NR	**-31.8 (6.5)**	**-4.2 (1.9) mg/dL**	**-22.6 (4.7) mg/dL**	5.1 (18.8) mg/dL	2.6 (2.1) mg/dL	0.4 (2.2) µIU/mL
Bhutani et al., 2013a[12]	**-3 ± 1 kg**	NR	NR	NR									
Bhutani et al., 2013b[13]	**3 ± 1 kg**	**-1 ± 0**	**-2 ± 1 kg**	-1 ± 1 kg	-3 ± 1	-2 ± 2	-0 ± 1	7 ± 4 mg/dL	**0 ± 4 mg/dL**	-1 ± 6 mg/dL	6 ± 6 mg/dL	-3 ± 2 mg/dL	-7 ± 6 µIU/mL
Varady et al., 2013[14]	**6.5 ± 1.0%**	NR	**-3.6 ± 0.7 kg**	No change	**-7 ± 2**	**-6 ± 2**	NR	**-26 ± 6 mg/dL**	-2 ± 3	**-18 ± 6 mg/dL**	-22 ± 11	NR	NR
Varady et al., 2011[2]	**-5.2 ± 1.1%**	NR	NR	NR	NR	NR	NR	No change*	NR	**-10 ± 4%**	**-17 ± 5%**	NR	NR
Bhutani et al., 2010[15]	**-5.7 ± 0.9 kg**	**-2.3 ± 0.2**	**-5.4 ± 0.8 kg**	**No change**	NR	NR	NR	NR	No change*	NR	NR	NR	NR
Heilbronn et al., 2005[16]	**2.5 ± 0.5%**	NR	NR	NR	No change*	No change*	NR	NR	NR	NR	NR	No change*	**-57 ± 4%**

Abbreviations: BMI, Body mass index; BP, Blood pressure; bpm, beats per minute; CI, Confidence interval; cm, centimetre; FBG, fasting blood glucose; HDL, high density lipoprotein; kg, kilogram; LDL, low density lipoprotein; SD, Standard deviation.
Data is reported as Mean ± SEM unless exclusively specified. ‡Data reported as median (IQR); †Data reported as change from baseline (95% CI); §Data reported as Mean ± SD; *P values are not reported.
Numerical values are rounded off up to one decimal places, numbers highlighted in bold depicts significant P values.

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