



International Journal of Innovative Technologies in Social Science

e-ISSN: 2544-9435

Operating Publisher
SciFormat Publishing Inc.
ISNI: 0000 0005 1449 8214

2734 17 Avenue SW,
Calgary, Alberta, T3E0A7,
Canada
+15878858911
editorial-office@sciformat.ca

ARTICLE TITLE	INTERMITTENT FASTING AND METABOLIC HEALTH: EVIDENCE FROM CLINICAL STUDIES
----------------------	---

DOI	https://doi.org/10.31435/ijitss.3(51).2026.6170
------------	---

RECEIVED	02 August 2026
-----------------	----------------

ACCEPTED	16 September 2026
-----------------	-------------------

PUBLISHED	25 September 2026
------------------	-------------------

LICENSE	
----------------	--



The article is licensed under a **Creative Commons Attribution 4.0 International License**.

© The author(s) 2026.

This article is published as open access under the Creative Commons Attribution 4.0 International License (CC BY 4.0), allowing the author to retain copyright. The CC BY 4.0 License permits the content to be copied, adapted, displayed, distributed, republished, or reused for any purpose, including adaptation and commercial use, as long as proper attribution is provided.

INTERMITTENT FASTING AND METABOLIC HEALTH: EVIDENCE FROM CLINICAL STUDIES

Adam Skrobarczyk (Corresponding Author, Email: skrobarczyk.adam@gmail.com)

4th Military Clinical Hospital with Polyclinic in Wrocław Rudolfa Weigla 5, 50-981 Wrocław, Poland

ORCID ID: 0009-0006-6391-2666

Karolina Rycman

Clinical Hospital of the Poznań University of Medical Sciences, Przybyszewskiego 49
60-355 Poznań, Poland

ORCID ID: 0009-0006-8144-6339

Izabella Sośniak

Brothers Hospitallers Hospital in Kraków, Trynitarzka 11, 31-061 Kraków, Poland

ORCID ID: 0009-0000-9438-6175

Agnieszka Dobrowolska

Provincial Hospital in Zgierz them. M. Skłodowska-Curie 95-100 Zgierz, ul. Parczewska 35, Poland

ORCID ID: 0009-0000-5645-7518

Zuzanna Drewniak

Praski Hospital in Warsaw, aleja Solidarności 67, 03-401 Warszawa, Poland

ORCID ID: 0009-0006-0426-4312

Marta Rząsa

Provincial Hospital in Zgierz them. M. Skłodowska-Curie 95-100 Zgierz, Parczewska 35, Poland

ORCID ID: 0009-0000-6817-6940

Kamil Wendrychowicz

Central Teaching Hospital of The Medical University of Łódź, Pomorska 251, 92-213 Łódź, Poland

ORCID ID: 0009-0005-5452-5384

Filip Wróbel

Norbert Barlicki Memorial Teaching Hospital No. 1 of the Medical University of Łódź,
Kopcińskiego 22, 90-153 Łódź, Poland

ORCID ID: 0009-0000-7572-9451

ABSTRACT

Background: While overweight and obesity currently affect more than 1.9 billion adults worldwide and represent major risk factors for the development of metabolic diseases, intermittent fasting (IF), also referred to as intermittent energy restriction (IER), is a dietary strategy characterized by the alternation of periods of habitual food and drink consumption with periods of voluntary fasting or substantial energy restriction.

Aim: This review aims to analyze recent evidence regarding the effects of intermittent fasting in comparison with conventional dietary recommendations in overweight and obese individuals. The objective is to provide evidence-based insights that may assist clinicians and patients in determining whether intermittent fasting constitutes a feasible and effective alternative to traditional dietary interventions for optimizing metabolic health and reducing the risk of chronic disease development.

Methods: To conduct this review, Pubmed and Google Scholar were searched independently for relevant articles. Numerous studies were reviewed, followed by an in-depth analysis, and compilation of their implications in health and disease.

Results: Intermittent fasting (IF) is generally as effective as, but not necessarily superior to, traditional daily caloric restriction (DCR) for weight loss.

Conclusions: While the short-term benefits (typically 3–6 months) are well-documented, there is a consensus that more high-quality, long-term randomized controlled trials (12 months or longer) are required. Further research is needed to evaluate IF's impact on hard clinical endpoints such as cardiovascular events, mortality, and its long-term safety in diverse or high-risk populations.

KEYWORDSAlternate-day Fasting, Body Composition, Intermittent Fasting, Metabolic Risk, Metabolism, Time-restricted Eating

CITATION

Skrobacz, A., Rycman, K., Sośniak, I., Dobrowolska, A., Drewniak, Z., Rząsa, M., Wendrychowicz, K., & Wróbel, F. (2026). Intermittent fasting and metabolic health: Evidence from clinical studies. *International Journal of Innovative Technologies in Social Science*, 3(51). [https://doi.org/10.31435/ijitss.3\(51\).2026.6170](https://doi.org/10.31435/ijitss.3(51).2026.6170)

COPYRIGHT

© **The author(s) 2026.** This article is published as open access under the Creative Commons Attribution 4.0 International License (CC BY 4.0), allowing the author to retain copyright. The CC BY 4.0 License permits the content to be copied, adapted, displayed, distributed, republished, or reused for any purpose, including adaptation and commercial use, as long as proper attribution is provided.

1.Introduction

Metabolic diseases, including obesity, type 2 diabetes mellitus, and metabolic syndrome, represent a major and rapidly growing global health burden. The prevalence of these conditions has increased significantly over recent decades, reaching epidemic proportions worldwide. They are strongly associated with increased cardiovascular morbidity and mortality, reduced quality of life, and substantial healthcare costs, placing a significant strain on public health systems. (1,2)

Lifestyle modification, particularly dietary intervention, remains the cornerstone of both prevention and management of metabolic disorders. Traditional continuous energy restriction has long been considered the standard dietary approach for weight reduction and metabolic improvement.(3,4) In this context, intermittent fasting has emerged as a popular and promising dietary pattern.

Intermittent fasting (IF) is a term encompassing various dietary patterns that cycle between periods of voluntary abstinence from food and drink and periods of normal caloric intake (2,5). Unlike traditional continuous energy restriction (CER) diets, which primarily focus on the quantity and macronutrient composition of food, IF emphasizes the temporal distribution of eating (5,6).

Physiological Basis: The Metabolic Switch

The primary biological mechanism underlying the efficacy of IF is the "metabolic switch" (7,8). This transition occurs when liver glycogen stores are depleted - typically after 12 to 36 hours of fasting - forcing the body to shift its energy metabolism from glucose utilization to the oxidation of fatty acids and the production of ketone bodies such as β -hydroxybutyrate and acetoacetate. This switch triggers cellular and molecular adaptations that enhance stress resistance, reduce inflammation, and improve glucose regulation (7,9).

Primary Types of Intermittent Fasting

The sources categorize the various IF protocols into several distinct patterns based on the duration and frequency of the fasting periods:

- Time-Restricted Eating (TRE): This is the most common form of IF, involving the consumption of all daily calories within a fixed window, typically ranging from 4 to 10 hours, followed by a fasting period of 14 to 20 hours(3,5,10,11).
 - A prevalent variant is the 16:8 model (16 hours of fasting and an 8-hour eating window)
 - Early TRE (eTRE) involves windows scheduled earlier in the day (e.g., 8:00 AM to 4:00 PM) to align with circadian rhythms
 - Late TRE (lTRE) shifts the window to the afternoon or evening(13)
- Alternate-Day Fasting (ADF): This regimen alternates between a "fast day" and a "feast day"
 - In zero-calorie ADF, no food is consumed on fast days
 - In Modified ADF (mADF), individuals consume approximately 25% of their energy needs (around 500–600 kcal) on fast days and eat ad libitum on feast days(14,15)

- Periodic Fasting (Twice-Weekly Fasting or 5:2 Diet): This pattern involves two non-consecutive days of severe calorie restriction (e.g., 500–700 kcal) and five days of normal, unrestricted eating each week (10)
- 4:3 Diet: A variant of periodic fasting where individuals restrict calories (typically by ~80%) on three non-consecutive days and eat ad libitum on the remaining four days(12)
- Fasting-Mimicking Diets (FMD): These protocols use a specific sequence of low-calorie, low-protein, and low-carbohydrate meals designed to induce the physiological state of fasting while still providing a minimal level of nutrients(7,15,16)

The aim of this review is to summarize and evaluate current evidence from clinical studies regarding the effects of intermittent fasting and evaluate it as a viable alternatives to traditional dieting for weight management and the improvement of metabolic health.

2.Methods

This work is a narrative review of the literature, the aim of which was to collect and systematize current scientific data on the effect of IF on metabolic health. A search for relevant publications was conducted using scientific databases: PubMed and Google Scholar using keywords such as “intermittent fasting”, “time-restricted eating”, “alternate-day fasting”, “caloric restriction”, “weight loss”, “metabolic health”, “obesity” and “overweight”. The search included studies published up to May 2026, with no geographical restrictions applied. Additional search filters included articles published within the last five years, review articles, systematic reviews, and randomized clinical trials conducted in humans and published in English accessible as a full text. A total of 46 publications focusing on the effects of intermittent fasting on metabolic health, weight loss, body composition, and overall efficacy were identified. Of these, 34 publications were included in the analysis based on the predefined publication date criteria. We excluded publications describing the detailed biological and molecular mechanisms of action of intermittent fasting. The duration of the included studies were 12 months or less: 6-month (24-week), 3-month (12- to 16-week), 8-week and 4-week trials. The population of participants included mainly adults with obesity (BMI ≥ 30), type 2 diabetes and metabolic syndrome, characterized by factors such as abdominal obesity, elevated triglycerides, or high blood pressure. The clinical trials described in the sources varied significantly in size, with participant numbers ranging from as few as 14 to over 400. The exclusion criteria ensured participant safety and minimize factors that could confound the results: pregnancy and lactation, history of eating disorders, serious chronic and systemic diseases such as malignant tumors, renal and hepatic dysfunction and severe cardiovascular events; episode of myocardial infarction or acute cerebrovascular event.

3.Clinical evidence

3.1.Effects of intermittent fasting on body weight loss

Intermittent fasting (IF) has been established as a potent non-pharmacological strategy for weight management, with clinical trials indicating that protocols lasting 4 to 24 weeks typically induce body weight reductions ranging from 4% to 10% in individuals with overweight or obesity (17). The primary driver of this weight loss is a spontaneous reduction in daily energy intake, often measured between 200 and 550 kcal, as participants naturally consume fewer calories when restricted to specific eating windows (3,6,18). Research comparing different protocols suggests that alternate-day fasting (ADF) often elicits more substantial short-term weight loss (4–7%) than time-restricted eating (TRE), which generally results in a 1–4% reduction (1,19). Long-term studies spanning 12 months demonstrate that TRE (specifically an 8-hour window) produces weight loss comparable to traditional daily calorie restriction (DCR), with participants achieving approximately 5% reduction from baseline (3,6,20). However, the efficacy of IF for weight loss appears most successful in the initial phase of 1 to 6 months, after which many participants experience a plateau due to metabolic adaptation or a decline in dietary adherence (21,22).

3.2.Effects of intermittent fasting on body composition

The weight loss achieved through intermittent fasting primarily targets fat mass and visceral adipose tissue, which are critical markers for cardiometabolic health (17,18,23). Protocols such as early time-restricted eating (eTRE) and ADF have been shown to significantly reduce total fat volume and abdominal visceral fat area (VFA) (1,23,24). While a reduction in fat-free mass (FFM) or lean muscle mass is a common byproduct of most weight-loss interventions, IF protocols show mixed results regarding muscle preservation (17,22,25). Some short-term ADF trials have reported significant muscle loss, accounting for up to 31.8% of total weight lost, which was not attenuated by low-dose protein supplementation alone (26). However, the integration of resistance training (RT) with TRE has proven highly effective in maintaining or even increasing muscle mass while simultaneously promoting fat mass reduction (27,28). Furthermore, 12-month trials comparing TRE and DCR found that both regimens led to similar losses in lean mass and bone mineral density, suggesting that TRE is no more deleterious to body composition than standard dieting (3,20).

3.3.Effects of intermittent fasting on metabolic health

Intermittent fasting (IF) exerts broad-spectrum benefits on metabolic health by triggering a "metabolic switch" from liver-derived glucose to adipose cell-derived ketones, which optimizes cellular fuel use and enhances metabolic flexibility. (11,21)

Glucose Metabolism and Insulin Sensitivity

Intermittent fasting protocols, particularly those involving meal replacements (MR) or restricted eating windows, have demonstrated profound effects on glycemic control. In the EARLY randomized clinical trial, a 16-week 5:2 MR intervention achieved a reduction in HbA1c of -1.9%, which was significantly greater than the reductions seen with standard pharmacological treatments such as metformin (-1.6%) or empagliflozin (-1.5%) (29). These benefits extend to other markers, including significant decreases in fasting plasma glucose (FPG) and fasting insulin levels across various populations, from those with prediabetes to patients with long-standing type 2 diabetes (19,29,30).

The timing of the eating window appears to be a critical determinant of success; early time-restricted eating (eTRE), which aligns food intake with morning circadian rhythms, has been shown to be more effective at improving glucoregulation and pancreatic beta-cell function than delayed eating patterns (6,31). Furthermore, IF has been linked to a reduction in circulating branched-chain amino acids (BCAAs), which are established metabolic hallmarks of insulin resistance and obesity (32). Clinical evidence also suggests that IF improves HOMA-IR scores and insulin sensitivity (QUICKI), even in individuals with metabolic syndrome (MetS), largely by reducing fat infiltration in the liver and pancreas (23).

Lipid Profile and Cardiovascular Protection

The impact of IF on lipid parameters is equally robust, often surpassing traditional daily calorie restriction in improving atherogenic dyslipidemia. Research consistently reports significant reductions in total cholesterol, LDL cholesterol, and triglycerides (15,33,34). For instance, a 4-week trial demonstrated that alternate-day fasting (ADF) elicited larger reductions in non-HDL cholesterol than time-restricted eating (TRE) due to its greater energy deficit and pronounced effect on the intracellular redox state (1). In specialized groups like night shift workers, IF was associated with significantly lower LDL-C levels compared to continuous energy restriction (33).

A unique advantage of IF, specifically observed in the INTERFAST-2 study, is the significant elevation of serum apolipoprotein M (apoM). This HDL-associated lipocalin is not only atheroprotective but also enhances insulin secretion through sphingosine-1-phosphate (S1P) signaling, creating a direct link between improved lipid function and better glucose regulation. Furthermore, IF protocols improve HDL cholesterol efflux capacity, which is inversely related to the risk of cardiovascular disease (35). In patients with metabolic syndrome, 8-hour TRE significantly improves the TG/HDL-c ratio - a key predictor of cardiovascular events - primarily through the reduction of visceral adipose tissue. These collective changes suggest that "watching the clock" facilitates a more favorable lipoprotein subclass distribution and effectively manages the lipid-related risks of metabolic syndrome (23).

3.4. Effectiveness of different types of intermittent fasting

The effectiveness of intermittent fasting varies significantly based on the specific protocol employed and the population studied. Alternate-day fasting is often cited as the most effective type for rapid weight loss and fat mass reduction, particularly in adults without obesity, due to its ability to create a larger energy deficit (1,19). Within the category of time-restricted eating, the 16:8 protocol (16 hours of fasting and 8 hours of eating) has demonstrated superior weight loss results compared to the less restrictive 14:10 protocol in obese patients with type 2 diabetes (30). The timing of the eating window also plays a crucial role; early time-restricted eating (eTRE), which aligns food intake with morning circadian rhythms, appears to be more beneficial for weight management and appetite suppression than delayed or evening eating windows (24,27,36). Despite the potency of ADF and the 5:2 diet, TRE is often considered a more viable long-term strategy for the general population because it reports significantly higher adherence rates (over 84%) compared to more restrictive fasting models (22,28). Specialized populations, such as night shift workers, have also successfully utilized modified 5:2 fasting schedules to achieve clinically relevant weight loss of 5.5 to 8.5 kg over 24 weeks (33).

3.5. Safety of Intermittent Fasting

Intermittent fasting (IF) is generally considered a safe and well-tolerated nutritional strategy for adults with overweight and obesity, with clinical trials consistently reporting a low incidence of serious adverse events (3,4,15,16). The safety profile of IF is comparable to that of traditional daily caloric restriction, and most reported side effects are categorized as mild, transient, and limited to the initial adaptation period, typically resolving within the first month of the intervention (3,5,7,9).

Commonly Reported Adverse Effects

Participants in intermittent fasting protocols frequently experience a range of physiological and psychological symptoms during the fasting window. These include headaches, dizziness, fatigue, irritability, nausea, and hunger (3–5,15,16,29,32,33). Additionally, some studies have noted minor occurrences of constipation, bad breath (halitosis), and a reduced ability to concentrate (7,15,30,31). While these symptoms are generally not severe enough to cause clinical concern, they can occasionally lead to dietary dissatisfaction and higher attrition rates in more restrictive protocols, such as alternate-day fasting (ADF) (4,5,14).

Safety in Clinical Populations

In patients with type 2 diabetes (T2DM), intermittent fasting is regarded as a safe adjunct treatment, provided it is conducted under professional medical supervision (5,17).

Hypoglycemia Risk: The most significant clinical concern for diabetic populations is the risk of hypoglycemia, which may be exacerbated when fasting is combined with antidiabetic medications like insulin or sulfonylureas (2,17,19). However, many trials have reported that documented episodes of severe hypoglycemia are rare when medication doses are appropriately adjusted by physicians (6,29,30).

Cardiovascular Safety: Evidence suggests that IF does not negatively impact cardiovascular markers; rather, it often leads to improvements in blood pressure and lipid profiles (5,21).

Long-Term Safety Considerations

While the short-term safety of IF (up to 6 months) is well-documented, there is currently limited high-quality evidence regarding its long-term (over 12 months) safety and sustainability (9,10,29). Most clinical trials are characterized by small sample sizes and short follow-up periods, which limits the ability to generalize safety outcomes to broader populations or longer durations (10,21). Therefore, further large-scale, multicenter trials are necessary to establish a definitive long-term safety consensus for the medical community (10).

3.6. Comparison of Intermittent Fasting and Daily Calorie restriction

Clinical research across the provided sources indicates that intermittent fasting (IF) and daily calorie restriction (DCR) are generally comparable in their effectiveness for weight management and metabolic health, though they differ significantly in application and adherence (3,28,33). Several 12-month randomized controlled trials found no significant difference in weight loss between time-restricted eating (TRE) and DCR (3,37). Some studies suggest IF may be more potent in the short term; for instance, a 6-month trial in adults with type 2 diabetes found TRE more effective for weight reduction (-3.6%) than DCR (-1.8%)(38). A key

finding is that IF, particularly TRE, often leads to a spontaneous reduction in energy intake (between 200 and 550 kcal/day) even when participants are not instructed to count calories, producing an effect similar to intentional DCR(6,20,38). Both strategies lead to similar improvements in blood pressure, lipid profiles (cholesterol and triglycerides), and glycemic control (fasting glucose and HbA1c) (3,3,20,33,37,38).

3.6.1. Adherence and Feasibility

Simplicity vs. Rigidity: IF, especially TRE, is often reported as easier to follow because it requires participants to simply "watch the clock" rather than count calories (6,20,28,38).

Adherence Rates: Adherence to TRE is typically higher (frequently over 84%) compared to DCR (approximately 61%), which can be frustrating due to the constant cognitive load of monitoring every meal (6,20,20,28).

Sustainability: While both are viable long-term strategies, the inherent flexibility of self-selected fasting windows may make IF more sustainable for individuals who struggle with the psychological strain of rigid dietary restraint. (25,39).

4. Discussion

Despite some promising findings detailed above, the validity and generalizability of Intermittent fasting research are constrained by several factors.

4.1. Duration

The limited duration of intervention periods constitutes a pervasive and significant limitation across the studies. Many trials are characterized by short-term designs, frequently ranging from only 4 to 12 weeks. These abbreviated timeframes are often insufficient to capture long-term metabolic adaptations or to assess the sustainability and durability of weight loss and health improvements.

4.2. Small sample size

A significant and pervasive limitation across the current body of evidence regarding intermittent fasting (IF) and time-restricted eating (TRE) is the frequent reliance on small cohorts. Many clinical trials are designed as pilot or feasibility studies, which typically involve a limited number of participants, thereby reducing the statistical power necessary to detect smaller but clinically relevant differences between intervention groups.

4.3. Blinding

The lack of blinding for both participants and study personnel represents a pervasive and significant methodological limitation. Because these interventions require participants to consciously adhere to specific dietary regimens, they are inherently aware of their treatment group, making traditional double-blind designs unfeasible. This awareness can introduce performance bias, where participants' expectations, motivation, or increased self-monitoring - rather than the physiological effects of the fasting protocol - influence outcomes like weight loss and dietary adherence. Furthermore, when study staff are not blinded, their interactions with participants during dietetic consults can inadvertently skew results or encourage better compliance in the intervention group.

5. Conclusions

In summary, the collective evidence from these studies demonstrates that intermittent fasting (IF) is a potent and viable alternative to traditional daily caloric restriction (DCR) for the management of obesity and its related metabolic complications. However the weight-reductive effects of IF are primarily driven by an unintentional energy deficit rather than a unique metabolic advantage in energy expenditure. Notably, early time-restricted eating (eTRE) has been shown to improve glycemic control and reduce oxidative stress even in the absence of weight loss, suggesting that the timing of food intake independent of caloric quantity is a critical determinant of metabolic health. In summary, while intermittent fasting is a safe and effective intervention for obesity treatment, future research must prioritize large-scale, long-term randomized controlled trials to confirm these findings across broader demographics and evaluate hard clinical outcomes, such as cardiovascular events and long-term disease remission.

Author Contributions: All authors have read and approved the final version of the manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

Funding: No funding was received to conduct this study.

REFERENCES

1. Derron, N., Güntner, A. T., Weber, I. C., Braun, J., Koska, İ. Ö., Othman, A., et al. (2025). Alternate-day fasting elicits larger changes in fat mass than time-restricted eating in adults without obesity – a randomized clinical trial. *Clin Nutr*, 53, 212–21. <https://doi.org/10.1016/j.clnu.2025.08.033>
2. Vasim, I., Majeed, C. N., & DeBoer, M. D. (2022). Intermittent fasting and metabolic health. *Nutrients*, 14(3), 631. <https://doi.org/10.3390/nu14030631>
3. Liu, D., Huang, Y., Huang, C., Yang, S., Wei, X., Zhang, P., et al. (2022). Calorie restriction with or without time-restricted eating in weight loss. *N Engl J Med*, 386(16), 1495–504. <https://doi.org/10.1056/NEJMoa2114833>
4. Ostendorf, D. M., Caldwell, A. E., Zaman, A., Pan, Z., Bing, K., Wayland, L. T., et al. (2022). Comparison of weight loss induced by daily caloric restriction versus intermittent fasting (DRIFT) in individuals with obesity: Study protocol for a 52-week randomized clinical trial. *Trials*, 23(1), 718. <https://doi.org/10.1186/s13063-022-06523-2>
5. Brasse, P., Zerdka, J., Staszkievicz, K., Staszkievicz, K. K., Piszka, M., Kwapien, E., et al. (2025). Intermittent fasting: Efficacy, safety, and its impact on body weight, glucose metabolism, and gut microbiota. *Cureus*. <https://doi.org/10.7759/cureus.97773>
6. Ezpeleta, M., Cienfuegos, S., Lin, S., Pavlou, V., Gabel, K., Tussing-Humphreys, L., et al. (2024). Time-restricted eating: Watching the clock to treat obesity. *Cell Metab*, 36(2), 301–14. <https://doi.org/10.1016/j.cmet.2023.12.004>
7. De Cabo, R., & Mattson, M. P. (2019). Effects of intermittent fasting on health, aging, and disease. *N Engl J Med*, 381(26), 2541–51. <https://doi.org/10.1056/NEJMr1905136>
8. Templeman, I., Thompson, D., Gonzalez, J., Walkin, J. P., Reeves, S., Rogers, P. J., et al. (2018). Intermittent fasting, energy balance and associated health outcomes in adults: Study protocol for a randomised controlled trial. *Trials*, 19(1), 86. <https://doi.org/10.1186/s13063-018-2451-8>
9. Garegnani, L. I., Oltra, G., Ivaldi, D., Burgos, M. A., Andrenacci, P. J., Rico, S., et al. (2026). Intermittent fasting for adults with overweight or obesity. *Cochrane Database Syst Rev*, 2026(2). <https://doi.org/10.1002/14651858.CD015610.pub2>
10. Wang, B., Wang, C., & Li, H. (2025). The impact of intermittent fasting on body composition and cardiometabolic outcomes in overweight and obese adults: A systematic review and meta-analysis of randomized controlled trials. *Nutr J*, 24(1), 120. <https://doi.org/10.1186/s12937-025-01178-6>
11. Manoogian, E. N. C., Wilkinson, M. J., O'Neal, M., Laing, K., Nguyen, J., Van, D., et al. (2024). Time-restricted eating in adults with metabolic syndrome: A randomized controlled trial. *Ann Intern Med*, 177(11), 1462–70. <https://doi.org/10.7326/M24-0859>
12. Catenacci, V. A., Ostendorf, D. M., Pan, Z., Kaizer, L. K., Creasy, S. A., Zaman, A., et al. (2025). The effect of 4:3 intermittent fasting on weight loss at 12 months: A randomized clinical trial. *Ann Intern Med*, 178(5), 634–44. <https://doi.org/10.7326/ANNALS-24-01631>
13. Gómez-Pérez, A. M., Bandera-Merchán, B., Martínez-Montoro, J. I., Gutiérrez-Bedmar, M., Díaz-Perdigones, C., Subiri-Verdugo, A., et al. (2025). Effect of a ketogenic diet, time-restricted eating, or alternate-day fasting on changes in ambulatory blood pressure: A sub-analysis of a randomized clinical trial. *Eur J Prev Cardiol*, zwaf567. <https://doi.org/10.1093/eurjpc/zwaf567>
14. Trepanowski, J. F., Kroeger, C. M., Barnosky, A., Klempel, M. C., Bhutani, S., Hoddy, K. K., et al. (2017). Effect of alternate-day fasting on weight loss, weight maintenance, and cardioprotection among metabolically healthy obese adults: A randomized clinical trial. *JAMA Intern Med*, 177(7), 930. <https://doi.org/10.1001/jamainternmed.2017.0936>
15. Jane, L., Atkinson, G., Jaime, V., Hamilton, S., Waller, G., & Harrison, S. (2015). . *Intermittent fasting interventions for the treatment of overweight and obesity in adults aged 18 years and over: a systematic review protocol: JBI Database Syst Rev Implement Rep*, 13(10), 60–8. <https://doi.org/10.11124/jbisrir-2015-2363>

16. Sutton, E. F., Beyl, R., Early, K. S., Cefalu, W. T., Ravussin, E., & Peterson, C. M. (2018). Early time-restricted feeding improves insulin sensitivity, blood pressure, and oxidative stress even without weight loss in men with prediabetes. *Cell Metab*, 27(6), 1212–1221.e3. <https://doi.org/10.1016/j.cmet.2018.04.010>
17. Song, D. K., & Kim, Y. W. (2023). Beneficial effects of intermittent fasting: A narrative review. *J Yeungnam Med Sci*, 40(1), 4–11. <https://doi.org/10.12701/jyms.2022.00010>
18. Martínez-Rodríguez, A., Rubio-Arias, J. A., García-De Frutos, J. M., Vicente-Martínez, M., & Gunnarsson, T. P. (2021). Effect of high-intensity interval training and intermittent fasting on body composition and physical performance in active women. *Int J Environ Res Public Health*, 18(12), 6431. <https://doi.org/10.3390/ijerph18126431>
19. Chair, S. Y., Cai, H., Cao, X., Qin, Y., Cheng, H. Y., & Ng, M. T. (2022). Intermittent fasting in weight loss and cardiometabolic risk reduction: A randomized controlled trial. *J Nurs Res*, 30(1), e185. <https://doi.org/10.1097/jnr.0000000000000469>
20. Lin, S., Cienfuegos, S., Ezpeleta, M., Gabel, K., Pavlou, V., Mulas, A., et al. (2023). Time-restricted eating without calorie counting for weight loss in a racially diverse population: A randomized controlled trial. *Ann Intern Med*, 176(7), 885–95. <https://doi.org/10.7326/M23-0052>
21. Patikorn, C., Roubal, K., Veettil, S. K., Chandran, V., Pham, T., Lee, Y. Y., et al. (2021). Intermittent fasting and obesity-related health outcomes: An umbrella review of meta-analyses of randomized clinical trials. *JAMA Netw Open*, 4(12), e2139558. <https://doi.org/10.1001/jamanetworkopen.2021.39558>
22. Cloos, A., Geisler, S., & Isenmann, E. (2025). Similar body composition outcomes following volumetric diet and time-restricted eating in middle-aged individuals: A 12-week randomized controlled trial. *Nutr J*, 24(1), 94. <https://doi.org/10.1186/s12937-025-01167-9>
23. He, M., Wang, J., Liang, Q., Li, M., Guo, H., Wang, Y., et al. (2022). Time-restricted eating with or without low-carbohydrate diet reduces visceral fat and improves metabolic syndrome: A randomized trial. *Cell Rep Med*, 3(10), 100777. <https://doi.org/10.1016/j.xcrm.2022.100777>
24. Steger, F. L., Jamshed, H., Bryan, D. R., Richman, J. S., Warriner, A. H., Hanick, C. J., et al. (2023). Early time-restricted eating affects weight, metabolic health, mood, and sleep in adherent completers: A secondary analysis. *Obesity*, 31(S1), 96–107. <https://doi.org/10.1002/oby.23614>
25. Oldenburg, N., Mashek, D. G., Harnack, L., Wang, Q., Manoogian, E. N. C., Evanoff, N., et al. (2025). Time-restricted eating, caloric reduction, and unrestricted eating effects on weight and metabolism: A randomized trial. *Obesity*, 33(4), 671–84. <https://doi.org/10.1002/oby.24252>
26. Pang, B. W. J., Yang, Y., Rashiqah, N., Huang, C. B., & Sim, D. W. (2025). Effects of four weeks of alternate-day fasting with or without protein supplementation—a randomized controlled trial. *Nutrients*, 17(23), 3691. <https://doi.org/10.3390/nu17233691>
27. Yu, Z., & Ueda, T. (2025). Early time-restricted eating improves weight loss while preserving muscle: An 8-week trial in young women. *Nutrients*, 17(6), 1022. <https://doi.org/10.3390/nu17061022>
28. Cui, T., Sun, Y., Ye, W., Liu, Y., & Korivi, M. (2025). Efficacy of time restricted eating and resistance training on body composition and mood profiles among young adults with overweight/obesity: A randomized controlled trial. *J Int Soc Sports Nutr*, 22(1), 2481127. <https://doi.org/10.1080/15502783.2025.2481127>
29. Guo, L., Xi, Y., Jin, W., Yuan, H., Qin, G., Chen, S., et al. (2024). A 5:2 intermittent fasting meal replacement diet and glycemic control for adults with diabetes: The EARLY randomized clinical trial. *JAMA Netw Open*, 7(6), e2416786. <https://doi.org/10.1001/jamanetworkopen.2024.16786>
30. Sukkriang, N., & Buranapin, S. (2024). Effect of intermittent fasting 16:8 and 14:10 compared with control-group on weight reduction and metabolic outcomes in obesity with type 2 diabetes patients: A randomized controlled trial. *J Diabetes Investig*, 15(9), 1297–305. <https://doi.org/10.1111/jdi.14186>
31. Hegedus, E., Vu, M. H., Salvy, S. J., Bakhsh, J., Goran, M. I., Raymond, J. K., et al. (2024). Randomized controlled feasibility trial of late 8-hour time-restricted eating for adolescents with type 2 diabetes. *J Acad Nutr Diet*, 124(8), 1014–28. <https://doi.org/10.1016/j.jand.2023.10.012>
32. Li, L., Li, R., Tian, Q., Luo, Y., Li, R., Lin, X., et al. (2024). Effects of healthy low-carbohydrate diet and time-restricted eating on weight and gut microbiome in adults with overweight or obesity: Feeding RCT. *Cell Rep Med*, 5(11), 101801. <https://doi.org/10.1016/j.xcrm.2024.101801>

33. Bonham, M. P., Leung, G. K. W., Rogers, M., Davis, R., Clark, A. B., Davis, C., et al. (2025). Intermittent fasting for weight loss in night shift workers: A three-arm, superiority randomised clinical trial. *eBioMedicine*, 117, 105803. <https://doi.org/10.1016/j.ebiom.2025.105803>
34. Arciero, P. J., Arciero, K. M., Poe, M., Mohr, A. E., Ives, S. J., Arciero, A., et al. (2022). Intermittent fasting two days versus one day per week, matched for total energy intake and expenditure, increases weight loss in overweight/obese men and women. *Nutr J*, 21(1), 36. <https://doi.org/10.1186/s12937-022-00790-0>
35. Pammer, A., Obermayer, A., Stadler, J. T., Pferschy, P. N., Tripolt, N. J., Habisch, H., et al. (2024). Effects of dietary interventions and intermittent fasting on HDL function in obese individuals with T2DM: A randomized controlled trial. *Cardiovasc Diabetol*, 23(1), 339. <https://doi.org/10.1186/s12933-024-02426-5>
36. Ruddick-Collins, L. C., Morgan, P. J., Fyfe, C. L., Filipe, J. A. N., Horgan, G. W., Westerterp, K. R., et al. (2022). Timing of daily calorie loading affects appetite and hunger responses without changes in energy metabolism in healthy subjects with obesity. *Cell Metab*, 34(10), 1472-1485.e6. <https://doi.org/10.1016/j.cmet.2022.08.001>
37. Lin, S., Cienfuegos, S., Ezpeleta, M., Gabel, K., Pavlou, V., Alexandria, S. J., et al. (2024). Time-restricted eating versus daily calorie restriction: Effect on sleep in adults with obesity over 12 months. *Nutrients*, 16(20), 3528. <https://doi.org/10.3390/nu16203528>
38. Pavlou, V., Cienfuegos, S., Lin, S., Ezpeleta, M., Ready, K., Corapi, S., et al. (2023). Effect of time-restricted eating on weight loss in adults with type 2 diabetes: A randomized clinical trial. *JAMA Netw Open*, 6(10), e2339337. <https://doi.org/10.1001/jamanetworkopen.2023.39337>
39. Breit, M. J., Caldwell, A. E., Ostendorf, D. M., Pan, Z., Creasy, S. A., Swanson, B., et al. (2025). Effects of 4:3 intermittent fasting on eating behaviors and appetite hormones: A secondary analysis of a 12-month behavioral weight loss intervention. *Nutrients*, 17(14), 2385. <https://doi.org/10.3390/nu17142385>