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THE IMPACT OF INTERMITTENT FASTING ON WEIGHT REDUCTION AND METABOLIC PARAMETERS — CURRENT STATE OF KNOWLEDGE

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ABSTRACT

Background: Intermittent fasting (IF) has emerged as a widely investigated dietary strategy for the management of obesity and metabolic disorders. Increasing evidence suggests that periodic energy restriction may improve body weight and metabolic parameters associated with cardiovascular disease and type 2 diabetes.
Aim: This review aimed to summarize the current evidence regarding the effects of intermittent fasting on body weight reduction, glucose–insulin metabolism, lipid profile, blood pressure, and inflammatory markers.
Methods: A narrative review of the literature indexed in PubMed was conducted, focusing primarily on publications from 2020–2025, including randomized controlled trials, systematic reviews, umbrella reviews, and meta-analyses evaluating intermittent fasting in adults with overweight, obesity, metabolic syndrome, or type 2 diabetes.
Results: Current evidence indicates that IF may promote moderate weight reduction, decrease visceral adiposity, improve insulin sensitivity, reduce fasting glucose and triglyceride concentrations, and modestly lower blood pressure. Early time-restricted eating appears particularly beneficial due to its alignment with circadian rhythms. However, most studies demonstrate that IF does not significantly outperform conventional caloric restriction when total energy deficit is comparable.
Conclusions: Intermittent fasting represents a promising nutritional strategy for improving metabolic health, particularly in individuals with obesity and metabolic syndrome. Nevertheless, long-term adherence, dietary quality, and sustained energy deficit remain the primary determinants of clinical effectiveness. Further long-term randomized controlled trials are required to establish the optimal IF protocols and their long-term safety.

KEYWORDS

Intermittent Fasting, Obesity, Insulin Sensitivity, Metabolism, Time-Restricted Eating

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Introduction

Obesity and obesity-related metabolic disorders currently represent one of the greatest public health challenges worldwide. The prevalence of overweight and obesity continues to increase, contributing to the growing incidence of type 2 diabetes, hypertension, dyslipidemia, and cardiovascular disease. Due to the limited long-term effectiveness of many conventional dietary interventions, alternative nutritional strategies such as intermittent fasting (IF) have gained increasing scientific and clinical interest.

Intermittent fasting refers not to a specific type of food but rather to a temporal pattern of eating. The most commonly studied models include alternate-day fasting (ADF), time-restricted eating (TRE), and the 5:2 diet [2,8]. Unlike traditional caloric restriction, IF involves periodic fasting periods or substantial reductions in energy intake during specific time windows.

Over the last decade, numerous clinical trials and meta-analyses have evaluated the effects of IF on weight loss and metabolic health. Particular attention has been paid to its effects on insulin sensitivity, circadian rhythm regulation, lipid metabolism, and inflammatory pathways [3,21,22]. Increasing evidence also suggests that some metabolic benefits of IF may occur independently of weight reduction [15].

This review summarizes the current scientific evidence regarding the impact of intermittent fasting on body weight reduction and metabolic parameters.

Methodology of the Review

The literature review was conducted using publications indexed in the PubMed database. Articles published between 2020 and 2025 were prioritized, including randomized controlled trials, meta-analyses, umbrella reviews, and systematic reviews evaluating the effects of intermittent fasting on metabolic parameters. Several earlier landmark publications describing the physiological mechanisms of IF were also included [21,22].

Studies involving adults with overweight, obesity, metabolic syndrome, or type 2 diabetes were analyzed. The primary outcomes included:

- body weight and body composition,
- insulin sensitivity,
- fasting glucose and HbA1c,
- lipid profile,
- blood pressure,
- inflammatory markers.

Metabolic Mechanisms of Intermittent Fasting

The metabolic mechanisms underlying the potential health benefits of intermittent fasting are complex and involve numerous hormonal and cellular adaptations induced by periodic energy restriction. During fasting, glucose and insulin concentrations gradually decline, leading to activation of lipolysis and increased utilization of fatty acids as an energy source [21].

Prolonged fasting also increases ketone body production, providing an alternative energy substrate for many tissues, including the brain. This phenomenon, often referred to as the "metabolic switch," is considered one of the key mechanisms underlying IF-related metabolic adaptations [26].

Periodic energy restriction activates multiple cellular pathways that enhance resistance to metabolic stress. These mechanisms include activation of AMP-activated protein kinase (AMPK), inhibition of the mechanistic target of rapamycin (mTOR) pathway, and stimulation of autophagy [21]. Such processes may improve mitochondrial function, reduce oxidative stress, and attenuate chronic inflammation.

Circadian rhythm regulation appears to play an important role in the metabolic effects of intermittent fasting. Food intake synchronized with the body's natural biological rhythm may improve glucose metabolism and insulin sensitivity, whereas disruption of circadian rhythms caused by late-night eating may contribute to obesity and insulin resistance [22].

Intermittent fasting may also influence the expression of genes associated with energy metabolism and mitochondrial function [40]. Additional evidence suggests that IF may affect gut microbiota composition, which plays a crucial role in regulating metabolic and inflammatory processes [3].

Effects of Intermittent Fasting on Body Weight Reduction

Weight reduction remains the best-documented effect of intermittent fasting. Numerous randomized controlled trials and meta-analyses have shown that IF can significantly decrease body weight, waist circumference, and fat mass in individuals with overweight and obesity [1–3,5].

One of the primary mechanisms responsible for weight reduction during IF is spontaneous reduction in total energy intake. Unlike conventional calorie restriction, most IF protocols do not require continuous calorie counting but instead rely on limiting eating windows or incorporating fasting periods [17].

A review of clinical studies investigating different IF models reported that average body weight reduction ranged from 3% to 8% of baseline body weight over intervention periods lasting from 8 to 24 weeks [3]. The greatest benefits were observed in individuals with visceral obesity and concomitant metabolic disorders. However, substantial heterogeneity between studies was noted, likely due to differences in fasting duration, participant characteristics, and dietary quality.

Time-restricted eating (TRE), which limits food intake to a specific daily time window, has been one of the most extensively investigated IF models. A randomized clinical trial involving overweight and obese individuals following a 16-hour fasting period and an 8-hour eating window for 12 weeks demonstrated moderate weight reduction; however, differences between the TRE and control groups were smaller than expected [5]. Additionally, partial loss of lean body mass was reported, highlighting the potential risk of muscle loss during IF in the absence of adequate protein intake and physical activity.

Two more restrictive TRE models involving 4-hour and 6-hour eating windows have also been evaluated. Both interventions resulted in significant reductions in body weight and fat mass, with the shorter eating window producing greater weight loss [6]. A shorter feeding window may therefore lead to more pronounced spontaneous caloric restriction.

Alternate-day fasting (ADF), considered one of the most restrictive IF models, has been compared with conventional daily caloric restriction in individuals with obesity. After 12 months, both interventions achieved similar reductions in body weight, and no superiority of ADF over standard calorie restriction was demonstrated [19]. Moreover, higher dropout rates were observed in the ADF group, suggesting lower long-term adherence to more restrictive fasting protocols.

Similarly a meta-analysis including studies lasting at least six months concluded that IF effectively promotes weight loss; however, its effects are generally comparable to those achieved with continuous caloric restriction [20, 23]. Clinically, this suggests that maintaining a sustained energy deficit is likely the key determinant of weight reduction, regardless of the dietary strategy used to achieve it.

Increasing attention has also been directed toward the effects of IF on body composition. Weight loss does not necessarily reflect selective fat mass reduction. Some studies suggest that poorly designed IF interventions may reduce lean body mass, particularly in the setting of inadequate protein intake and insufficient physical activity. However, combining TRE with resistance training appears to facilitate fat loss while preserving lean body mass [18]. These findings indicate that a properly balanced diet and regular exercise may minimize unfavorable body composition changes during IF.

The combination of TRE and a low-carbohydrate diet has been shown to reduce body weight and visceral adiposity in patients with metabolic syndrome [8]. Since visceral adiposity plays a major role in insulin resistance and cardiovascular disease development, these findings suggest that combining IF with appropriate dietary composition may enhance metabolic benefits.

Importantly, improvements in insulin sensitivity and reductions in fasting insulin concentrations have been observed during early time-restricted feeding despite the absence of significant weight loss [15]. These findings suggest that IF may exert metabolic effects through hormonal adaptations and circadian mechanisms beyond caloric restriction alone.

Overall, current evidence suggests that intermittent fasting may be an effective strategy for weight reduction, particularly among individuals with obesity and metabolic syndrome. Nevertheless, most studies indicate that IF does not clearly outperform traditional caloric restriction when overall energy deficit is equivalent [19,20,23].

Effects of Intermittent Fasting on Lipid Metabolism

Dyslipidemia represents a major cardiovascular risk factor and an essential component of metabolic syndrome. Therefore, the effects of intermittent fasting on lipid metabolism have been extensively investigated.

Current evidence suggests that IF may improve several lipid parameters, particularly triglyceride concentrations [1,2,12]. The underlying mechanisms likely include reduced insulin levels, increased lipolysis, enhanced fatty acid oxidation, and reduced hepatic lipogenesis.

An umbrella review and network meta-analysis evaluating various IF models reported that alternate-day fasting produced the most pronounced reductions in triglyceride concentrations [2]. Moderate improvements in total cholesterol and LDL cholesterol were also observed.

A 10-hour TRE intervention significantly reduced LDL cholesterol and non-HDL cholesterol in patients with metabolic syndrome [9]. Similar reductions in triglycerides and LDL cholesterol have been observed following both 4-hour and 6-hour feeding interventions [6].

Additional evidence indicates improvements in the triglyceride-to-HDL ratio accompanied by reductions in visceral adipose tissue among individuals following TRE combined with a low-carbohydrate diet [8].

Meta-analytic evidence suggests that TRE produces moderate improvements in triglycerides and total cholesterol while exerting limited effects on HDL cholesterol [1,23].

Some evidence also suggests that IF may alter LDL particle size and composition, potentially reducing the proportion of small dense LDL particles associated with increased atherogenicity. However, evidence in this area remains limited.

Overall, current findings indicate that IF may positively affect lipid metabolism, especially by lowering triglyceride concentrations. Nevertheless, its superiority over traditional caloric restriction remains uncertain [19,20].

Effects of Intermittent Fasting on Glucose–Insulin Metabolism

The effects of intermittent fasting on glucose-insulin homeostasis represent one of the most intensively studied aspects of IF research.

Current evidence indicates that IF may improve insulin sensitivity, lower fasting insulin concentrations, reduce fasting glucose levels, and decrease HOMA-IR scores [1,3,13,14]. These benefits are particularly evident in individuals with obesity, prediabetes, and type 2 diabetes.

One of the landmark studies evaluating early time-restricted feeding in men with prediabetes demonstrated significant improvements in insulin sensitivity, fasting insulin concentrations, and oxidative stress markers despite minimal weight loss [15].

Circadian alignment appears to play an important role in glucose metabolism and insulin regulation. Consuming meals earlier in the day may improve pancreatic β-cell function and insulin responsiveness [22].

Significant reductions in fasting glucose and HOMA-IR have been reported in meta-analyses of randomized controlled trials evaluating TRE [1]. Similar findings have been reported across multiple IF protocols, including reductions in hyperinsulinemia and improvements in insulin sensitivity [3].

Evidence from systematic reviews suggests that IF may reduce fasting glucose, HbA1c, and the need for glucose-lowering medications in individuals with type 2 diabetes [13]. However, caution is required in patients receiving insulin or sulfonylureas because of the increased risk of hypoglycemia.

Additional systematic reviews have demonstrated improvements in glycemic control among individuals with diabetes and prediabetes following TRE interventions [14]. Improvements in glucose tolerance and postprandial insulin responses have also been reported after TRE interventions [36].

Although many studies report favorable effects of IF on glucose metabolism, evidence comparing IF with continuous caloric restriction remains mixed. Long-term studies have generally found no significant differences between IF and traditional caloric restriction in metabolic outcomes [19,20].

Thus, current evidence suggests that IF may improve glucose-insulin metabolism through both weight-dependent and weight-independent mechanisms. Early time-restricted feeding appears particularly promising due to its alignment with circadian metabolic rhythms [15,22].

Effects of Intermittent Fasting on Blood Pressure

Hypertension is one of the most important cardiovascular risk factors and a major component of metabolic syndrome. Several studies suggest that intermittent fasting may contribute to modest reductions in systolic and diastolic blood pressure [9,15].

Potential mechanisms include weight loss, improved endothelial function, reduced sympathetic nervous system activity, decreased insulin resistance, and attenuation of chronic inflammation.

Early time-restricted feeding has been associated with significant reductions in both systolic and diastolic blood pressure despite minimal weight loss [15]. Similar improvements have been observed following 10-hour TRE interventions in patients with metabolic syndrome [9].

Meta-analyses indicate that reductions in blood pressure are generally moderate and strongly associated with the degree of weight loss [1,20]. Nevertheless, even modest reductions may provide clinically meaningful cardiovascular benefits.

Circadian synchronization of eating patterns may influence autonomic nervous system regulation and vascular function [22]. Improvements in insulin sensitivity and reductions in oxidative stress may also contribute to blood pressure lowering.

Although promising, current evidence remains limited by short intervention durations and heterogeneity among studies. Larger long-term clinical trials are needed to better evaluate the cardiovascular implications of IF.

Effects of Intermittent Fasting on Inflammatory Markers and Oxidative Stress

Chronic low-grade inflammation plays a crucial role in obesity, metabolic syndrome, type 2 diabetes, and cardiovascular disease. Visceral adipose tissue secretes numerous pro-inflammatory cytokines, including interleukin-6 (IL-6), tumor necrosis factor α (TNF-α), and C-reactive protein (CRP).

Current evidence suggests that IF may attenuate inflammation and oxidative stress through multiple mechanisms, including reduction of visceral adiposity, activation of autophagy, improvement of mitochondrial function, and enhancement of cellular stress resistance [21].

Intermittent fasting activates pathways associated with improved cellular resilience and reduced oxidative damage [21]. Reductions in oxidative stress markers have also been observed during early time-restricted feeding despite the absence of substantial weight loss [15].

Several studies have reported reductions in inflammatory markers and improvements in oxidative–antioxidative balance during IF interventions [3]. Additional evidence suggests that IF may reduce reactive oxygen species production and improve mitochondrial efficiency [16].

Emerging evidence also indicates that IF may beneficially influence gut microbiota composition and intestinal barrier integrity, thereby reducing endotoxemia and chronic inflammation [3].

However, findings regarding inflammatory markers remain inconsistent. Some studies reported reductions in CRP and IL-6, whereas others found no significant changes, particularly in short-term interventions [1,3]. Variability in study design, participant characteristics, and fasting protocols likely contributes to these discrepancies.

Overall, current evidence suggests that IF may reduce oxidative stress and chronic inflammation, although further long-term studies are necessary to clarify these effects.

Discussion

Intermittent fasting is currently one of the most extensively investigated dietary interventions for obesity and metabolic disorders. Available evidence suggests that IF may improve body weight, insulin sensitivity, glucose homeostasis, lipid metabolism, blood pressure, and inflammatory status [1–3,15,21].

The most consistent finding across studies is moderate body weight reduction accompanied by decreases in visceral adipose tissue [5,6,8]. Nevertheless, most evidence indicates that IF does not clearly outperform continuous caloric restriction when equivalent energy deficits are achieved [19,20,23].

Importantly, some metabolic benefits appear to occur independently of weight loss, particularly in studies evaluating early time-restricted feeding [15]. These observations support the hypothesis that circadian alignment and fasting-induced metabolic adaptations may contribute directly to metabolic improvement.

The effects of IF on glucose-insulin metabolism appear especially promising. Improvements in fasting glucose, insulin sensitivity, and HOMA-IR have been consistently observed in individuals with obesity and prediabetes [1,3,14,15]. Similar but more moderate effects have been observed regarding lipid metabolism and blood pressure [1,9,20].

Evidence regarding inflammatory markers remains less consistent, although mechanistic studies strongly support the anti-inflammatory and antioxidative potential of IF [21].

Despite encouraging findings, several important limitations should be acknowledged. Many studies have relatively short durations, involve small sample sizes, and employ heterogeneous fasting protocols. Furthermore, long-term adherence remains a major challenge, particularly in more restrictive IF models such as alternate-day fasting.

Therefore, IF should not be considered a universally superior dietary strategy but rather one of several potential approaches to metabolic health improvement. Individualization of dietary interventions based on patient preferences, lifestyle, and metabolic status remains essential.

Conclusions

Intermittent fasting represents a promising dietary strategy that may positively influence body weight reduction and metabolic health. Current evidence suggests that IF can improve insulin sensitivity, reduce fasting glucose and triglyceride levels, decrease blood pressure, and lower visceral adiposity, particularly in individuals with obesity and metabolic syndrome [1–3,15].

The strongest evidence concerns improvements in glucose-insulin metabolism and reductions in visceral fat. Increasing data also suggest that some metabolic effects may occur independently of body weight reduction through circadian and cellular mechanisms.

However, most studies do not demonstrate clear superiority of IF over conventional caloric restriction. Long-term energy deficit, dietary quality, and adherence remain the key determinants of metabolic success.

Among IF protocols, early time-restricted eating appears particularly promising due to its alignment with circadian rhythms and potential metabolic benefits independent of weight loss [15,22]. Nevertheless, further long-term randomized controlled trials are necessary to better define the efficacy, safety, and clinical applications of intermittent fasting.

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