



Intermittent Fasting and Its Relationship with Body Health- An Updated Review

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Abstract:

Background: Intermittent fasting (IF) and time-restricted eating (TRE) protocols are becoming popular for promoting health, with evidence supporting benefits like weight loss, enhanced immune function, and reduced risks for diseases such as diabetes, cancer, and cardiovascular conditions. The historical and religious contexts of fasting underscore its longstanding role in human culture, while modern research explores its metabolic effects, including the impact on insulin sensitivity, inflammation, and lipid metabolism. This review aims to update the scientific understanding of IF and its association with health outcomes.

Aim: To evaluate the relationship between intermittent fasting and various health benefits, focusing on metabolic health, aging, immune function, and disease prevention. The review aims to highlight the mechanisms by which IF impacts health and explores the efficacy of different fasting protocols.

Methods: The review examines a broad range of studies, including animal models, clinical trials, and molecular studies. Various IF regimens, such as the 5:2 diet, 16:8 method, and alternate-day fasting, are analyzed for their effects on metabolic health, aging, cardiovascular function, and disease prevention. The review also considers the molecular mechanisms underlying these benefits, such as autophagy, mitochondrial function, and circadian rhythms.

Results: Research indicates that IF leads to weight loss, improved insulin sensitivity, reduced blood pressure, and enhanced lipid profiles. Studies also suggest that IF may protect against cardiovascular diseases, slow the aging process, and improve immune responses. While some results are variable, IF protocols such as 16:8 have shown positive effects on metabolic syndrome, reducing risks for diabetes, obesity, and heart disease. The molecular mechanisms include improved cellular repair processes, autophagy, and better regulation of circadian rhythms.

Conclusion: Intermittent fasting emerges as a promising approach to improve overall health, with substantial benefits in metabolic health, weight management, and disease prevention. However, further long-term, large-scale studies are needed to fully understand the differential impacts of various IF protocols. Additionally, the timing and quality of food intake, along with personalized approaches, may enhance the therapeutic outcomes of IF.

Keywords: Intermittent fasting, time-restricted eating, metabolic health, weight loss, autophagy, circadian rhythms, cardiovascular disease, immune function, diabetes prevention, aging.

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Introduction:

Intermittent fasting (IF), along with other time-restricted eating (TRE) protocols, is emerging as a widely accepted long-term approach for maintaining a healthy lifestyle. This growing interest is attributed to the multitude of benefits associated with IF, which include weight loss, immune system enhancement, reduced risks of diabetes, cancer, and cardiovascular diseases, as well as the potential to slow the ageing process. Research conducted on animal models suggests that IF may promote longevity, enhance metabolic health, and induce favorable hormonal changes. Furthermore, IF appears to have a positive impact on inflammatory responses, lipid metabolism, and insulin sensitivity. The term "intermittent fasting" encompasses various calorie-restricted fasting regimens, including the 5:2 diet, where one fasts for two days a week and consumes a normal diet on the remaining days; the 16:8 method, in which eating is limited to an 8-hour window and fasting is observed for 16 hours; and alternate-day fasting, where fasting occurs every other day, among other protocols. In the majority of reported instances, these fasting approaches have proven to be safe, with numerous clinical studies indicating significant metabolic benefits and only minimal side effects. Available evidence supports the notion that fasting can serve as a viable alternative to pharmaceutical interventions for maintaining health and energy balance, offering substantial public health advantages.

Fasting in Religious and Historical Contexts

Fasting is not a novel practice but has deep historical roots within various religious and spiritual traditions. In Christianity, fasting is often regarded as a means of drawing closer to God. In Buddhism, practitioners typically refrain from eating after noon, dedicating the remaining time to meditation. Hindus believe that detaching from food through fasting purifies both mind and body, offering spiritual benefits, while in Islam, fasting is a religious observance aimed at reinforcing faith and piety. The association between fasting and health has a longstanding history, tracing back to the publication of "Fasting for the Cure of Disease" in 1908 by Linda B. Hazzard, who advocated for fasting as a cure for a range of ailments, including infections, headaches, and even sexual dysfunction. However, Hazzard's practices resulted in several deaths, including her own, underscoring the potential hazards of unsupervised fasting. Despite this, contemporary scientific literature continues to support the idea that intermittent fasting and time-restricted eating can confer health benefits.

The Evolution of Fasting Practices and Understanding Cellular Metabolism

Our understanding of cellular metabolism has evolved significantly since the late 18th century, beginning with the experiments of the renowned chemist Antoine Lavoisier. In 1782, Lavoisier conducted experiments with frozen guinea pigs, establishing the link between chemistry and physiology. By placing guinea pigs in a bucket insulated with ice, he collected the melted water and calculated the energy expended by the animals to melt the ice, attributing this energy to respiration. Metabolism, a complex and ongoing chemical process, is essential for sustaining the body's functions by converting food into metabolic intermediates and energy to power physiological processes. Metabolic rates, whether slow, fast, or average, are influenced by endocrine systems and are heavily impacted by factors such as age, lifestyle, diet, and physical activity levels. As metabolism is a dynamic system, it has evolved over millions of years, originating from our bacterial ancestors, to ensure survival and reproduction. Intermittent fasting, reflecting a "feast and famine" pattern, was a natural part of the existence of both animals and early humans during evolutionary history. It provided a means of manipulating metabolism, yielding benefits such as weight loss, enhanced stress resistance, reduced inflammation, and various physiological changes at the cellular level. This adaptive response remains conserved across species, including humans, and plays a significant role in promoting overall health.

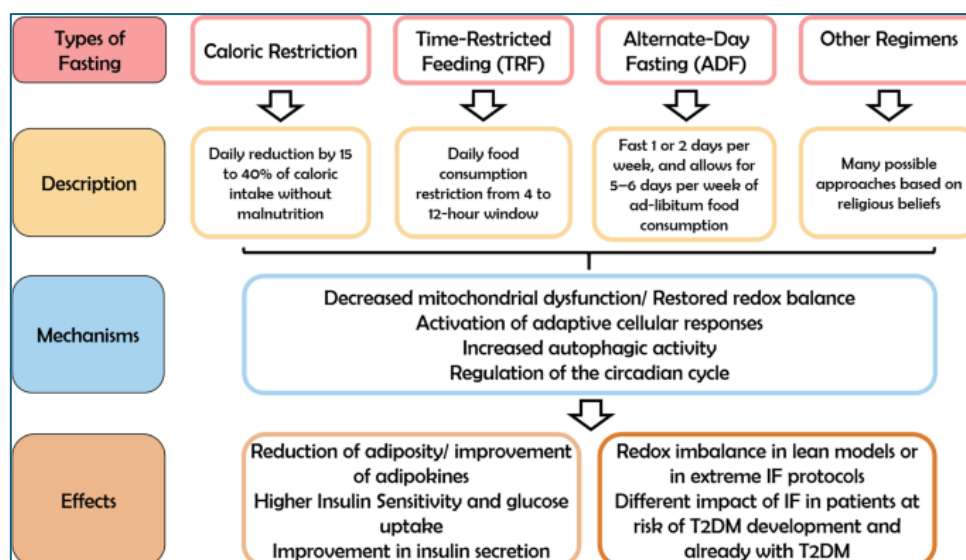


Figure 1: Types of Fasting.

Molecular Mechanisms Underlying the Health Benefits of Fasting

Fasting has been shown to upregulate various metabolic markers, such as organic acids, coenzymes, antioxidants, purines, and pyrimidines, in healthy young individuals following a 58-hour fasting period [2]. These metabolites activate multiple metabolic pathways, including those involved in antioxidant defense, mitochondrial activity, purine and pyrimidine biosynthesis, and the pentose phosphate pathway [2]. Fasting has been associated with sustained positive effects on health indicators, including improved insulin sensitivity, reduced blood pressure, decreased body fat, and enhanced glucose homeostasis and lipid metabolism [3–5]. Moreover, fasting has been shown to promote the regeneration and differentiation of various tissues and cells, while also strengthening the body's antitumor immunity [6, 7]. Research involving both animal models and human clinical trials indicates that fasting can lead to significant changes in the gut microbiome, autophagy, and mitochondrial function, underscoring its potential therapeutic applications [8–14].

Current Evidence for Health Benefits of Fasting

A substantial body of research has demonstrated that caloric restriction (CR), which involves reducing food intake by 30–40% below ad libitum intake levels while maintaining essential nutrients and preventing malnutrition, effectively mitigates several chronic degenerative inflammatory diseases [15]. This outcome is achieved through the activation of autophagy [16–18], a cellular degradation process that breaks down aged proteins and organelles, playing a crucial role in cellular viability, regeneration, and homeostasis [18, 19]. Evidence suggests that CR may be the most effective intervention for slowing aging, extending lifespan, and delaying the onset of age-related diseases, as observed in various species including fruit flies, rodents, and mammals, where these processes have been studied comprehensively [17, 20–27].

Intermittent fasting (IF) has been reported to yield results comparable to CR in randomized controlled trials, particularly in promoting weight loss and metabolic improvements [28], a finding that is unsurprising given the overlapping principles between these approaches. Fasting regimens such as IF and other time-restricted eating (TRE) strategies are likely effective not only because they restrict food intake but also because they contribute to reduced overall caloric consumption. These fasting protocols, including alternate-day fasting and other IF approaches, have consistently demonstrated effectiveness in achieving mild to moderate weight loss and a sustained reduction in blood pressure [29]. Despite the growing public, media, and scientific interest in the health benefits of IF, more long-term, evidence-based human studies are required to fully understand the differential impacts, if any, of various IF protocols and to explore potential negative effects. This review briefly examines the reported benefits of IF on several metabolic health aspects and, where available, explores the molecular mechanisms underpinning these effects.

Cardiometabolic Health

Metabolic syndrome, also referred to as syndrome X, is a pathological condition characterized by a combination of cardiovascular risk factors such as insulin resistance, abdominal obesity, atherogenic dyslipidemia, and hypertension [30]. Extensive studies provide compelling evidence that IF serves as a safe and promising strategy to prevent chronic diseases, maintain a healthy weight, and enhance metabolic health. Various IF regimens have been shown to significantly reduce fasting insulin levels [31–33] and HbA1c (glycated hemoglobin) [34–37] in individuals with obesity and/or prediabetes.

The majority of studies examining fasting regimens report body weight reductions ranging from 1.3 to 84%, accompanied by improvements in metabolic health indicators [32, 33, 38–42]. The beneficial effects of weight loss following IF, particularly in terms of blood pressure reduction, may contribute to the long-lasting antihypertensive effects observed after fasting [43]. In addition to its effects on body weight, IF has been shown to positively influence cardiovascular health, independent of weight changes [44, 45]. IF protocols have also been demonstrated to reduce both systolic and diastolic blood pressure [34, 36, 38, 40, 45–47]. The observed reductions in blood pressure during fasting have led some experts to suggest the reduction or discontinuation of antihypertensive medications during fasting therapy to avoid complications such as symptomatic hypotension and hyponatremia [15]. Even following refeeding, blood pressure levels can remain lower than baseline for extended periods, ranging from weeks to months, depending on post-fasting dietary and lifestyle habits [15]. IF has also been found to reduce LDL cholesterol levels [34, 35, 40, 47–49] and triglyceride concentrations [35, 36, 40, 41, 47–49], although results have been variable. The impact of IF on circulating inflammatory markers, such as TNF- α , has generally been minimal, with few studies reporting significant reductions in inflammatory markers during fasting [41, 47]. Nevertheless, some studies have noted a significant reduction in oxidative stress levels during IF [47].

Additionally, IF has been associated with reduced risks of coronary artery disease and diabetes [50, 51]. Epidemiological studies have highlighted that routine periodic fasting, as practiced by certain religious groups, is correlated with a decreased risk of coronary heart disease in individuals undergoing coronary angiography [51]. Both CR and IF have been shown to attenuate age-related changes in the heart and vasculature, likely through cellular mechanisms directly linked to the fasting process [15]. Alternate-day fasting has been shown to reduce apoptosis levels in the peri-infarct area in experimental ischemia models [52] and to enhance ischemic preconditioning [53]. A recent comprehensive review of randomized clinical trials in human subjects concluded that IF offers benefits in lowering cardiovascular risk factors by improving lipid profiles, metabolic syndrome indicators, insulin sensitivity, and reducing body weight and inflammatory biomarkers [54]. In preparing this review, we found significant evidence supporting the role of IF in reducing cardiovascular risks. However, we chose not to include non-peer-reviewed reports suggesting potential harm of IF to cardiovascular health. Many of these studies lack crucial information regarding factors such as dietary quality, the duration of eating windows, alcohol consumption, and physical activity levels. Moreover, most studies are of short duration and focus on healthy adults or individuals with obesity and prediabetes. There is a notable absence of long-term studies involving individuals with pre-existing cardiovascular conditions. Further controlled, randomized, long-term clinical trials with larger sample sizes, incorporating detailed information on preexisting conditions, lifestyle factors, and varying IF protocols, are necessary to better understand the full impact of IF on cardiovascular disease.

Cancer

Over a century ago, Moreschi observed that tumors grafted into mice grew more slowly and less frequently in animals subjected to low-calorie diets [55]. This finding was later confirmed by Rous, who demonstrated that transplanted tumors in underfed mice exhibited slower growth compared to controls [56]. In cancer patients, fasting has been shown to reduce tumor growth and associated side effects, while simultaneously enhancing the efficacy of chemotherapy [57, 58]. Intermittent fasting (IF) has also been reported to inhibit cancer cell growth by interfering with their energy metabolism, thereby increasing their susceptibility to cancer therapies [59–61]. IF has the potential to suppress tumor growth and improve survival rates in patients with glioblastoma [62, 63]. Additionally, periodic fasting has been found effective in reducing

preneoplastic lesions [64]. Fasting promotes tissue regeneration and differentiation, enhancing antitumor immunity [6]. This regenerative and differentiating effect on tissues and cells strengthens antitumor immunity, contributing to the overall therapeutic potential of fasting [6, 7].

Circadian Rhythms

The endogenous circadian clock, an evolutionary product, is crucial for optimizing several physiological processes across diverse organisms. The time of day plays a significant role in integrating metabolism, energetics, physical coordination, hormonal secretion, and sleep in animals [65]. Disruption of the synchrony between the suprachiasmatic nuclei in the hypothalamus and similar peripheral sensors, such as those in the liver, leads to energy balance disturbances [66], thereby increasing the risk of chronic diseases [67]. Research suggests that fasting-related benefits are partly achieved by regulating peripheral circadian clocks, including those in the liver, muscle, adipose tissue, and intestines. Additionally, circadian rhythms influence bacterial populations and gut microbiome activity [68–71].

In addition to what we eat, when we eat plays a critical role in maximizing the benefits of fasting. The duration and timing of fasting may be more significant for health outcomes than the quantity of food or nutrient composition consumed [72, 73]. The regulation of feeding-fasting cycles impacts the expression of tissue-specific transcription factors, which, in concert with clock proteins, govern rhythmic gene expression [74, 75]. Research suggests that early eating within an 8-hour window, avoiding food after 3:00 p.m., leads to reduced appetite, lower blood pressure, and delayed diabetes onset, compared to eating over a 12-hour window [76]. The timing of eating may influence carbohydrate and lipid metabolism since circadian rhythms regulate metabolic pathways differently during the day and night. As a result, the same foods may yield different metabolic outcomes depending on the timing of consumption. For instance, individuals who eat late at night tend to oxidize more carbohydrates and less lipids compared to those who refrain from late-night snacking but consume breakfast [77]. Circadian misalignment, common in shift workers, is associated with adverse metabolic effects and reduced glucose tolerance, heightening the risks of type 2 diabetes, cardiovascular disease, and cancer [78–82]. Shift workers, such as firefighters, may benefit from maintaining a consistent 10-hour eating window (7:00 a.m. to 9:00 p.m.), which may mitigate the health consequences linked to circadian rhythm disruption, including heightened diabetes and cardiometabolic disorder risks [83]. Further investigation is needed to explore the potential clock-dependent metabolic effects of fasting, such as those on glycogenolysis, gluconeogenesis, nutrient absorption, and non-insulin-mediated glucose uptake.

The Gut Microbiome

Fasting and feeding rhythms significantly influence the composition of the gut microbiota [84, 85]. IF is believed to modulate metabolic regulation through the gut microbiome, as well as key lifestyle behaviors, such as sleep [86]. In mice subjected to an alternate-day fasting regimen, beige fat thermogenesis was selectively activated, alleviating obesity-related metabolic diseases, likely through the microbiota-beige-fat axis [10]. Fecal transplants from IF-treated mice to naive recipients have been shown to enhance antioxidative microbial metabolic pathways [87]. An 8-week IF regimen significantly reduced fat mass and oxidative stress, while improving inflammatory cytokine levels and vasodilatory parameters. A 2-day IF treatment improved adipokines, prevented lipid peroxidation, and enhanced vascular endothelial function in individuals with multiple sclerosis (MS). These effects were linked to alterations in gut microbiota composition, microbial metabolites, and metabolic pathways within the intestinal microbiome [88]. Changes in the gut microbiota associated with obesity can impair gut permeability and promote bacterial translocation, contributing to systemic inflammation [89]. Numerous studies in both animal models and human controlled trials support the notion that fasting induces changes in the gut microbiome, autophagy, and mitochondrial functions [8–14]. Fasting and caloric restriction (CR) have been reported to offer anti-inflammatory and neuroprotective benefits in animal models of stroke and systemic infections, as well as in humans with inflammatory conditions [41]. Notably, fasting has been shown to protect against autoimmunity in MS patients through alterations in the gut microbiome [87]. Additionally, IF has been observed to reduce inflammation, demyelination, and axonal damage in murine models of experimental

autoimmune encephalomyelitis [87, 91, 92]. Variability in the effects of IF between individuals may be partially explained by differences in gut microbiota composition [93].

Aging

The progressive decline in physiological processes with age is, in part, due to the accumulation of reactive oxidative metabolites [94–97]. Over 75 years ago, it was established that CR can extend maximal lifespan. The brain, heart, and skeletal muscle are particularly susceptible to oxidative damage, making them prime targets for age-related disorders that CR helps attenuate [97, 98]. Fasting has been shown to improve systemic metabolic indices and enhance the function of various organs, thereby creating a beneficial feedback loop, particularly in young adults [99–101]. In older adults with mild cognitive impairment, a 36-month IF regimen may reduce oxidative stress by increasing superoxide dismutase activities [102, 103]. Fasting has also been demonstrated to delay cognitive impairment, enhance hippocampus-dependent memory, and slow the progression of Alzheimer's disease, although the mechanisms underlying these effects remain poorly understood [13, 104–106]. Mitochondrial dysfunction and oxidative stress are hallmarks of both aging and various diseases, including ischemia-reperfusion injury [107, 108]. Fasting may significantly protect against acute liver and kidney injuries, as well as renal fibrosis, in animal models of ischemia-reperfusion [107, 109–111]. Moreover, fasting has been linked to a reduction in DNA damage through the upregulation of key DNA repair proteins, such as apurinic/apyrimidinic endonuclease-1 [58]. Notably, fasting has been suggested to promote telomere lengthening by suppressing mTOR signaling in planarian stem cells [112].

Ketogenesis

Fasting plays a critical role in mitigating disruptions in glucose and lipid metabolism, promoting stem cell and organ regeneration, and inhibiting disease progression, particularly in individuals with obesity and metabolic syndromes [113, 114]. When glucose stores are exhausted, cells undergo various adaptive metabolic responses, such as reducing basal metabolic rates, engaging in lipolysis, and initiating ketogenesis. These processes also involve hormonal modulation and a reduction in oxidative stress and inflammation [68, 86, 115, 116]. In a state of low blood glucose, ketone bodies and lactic acid emerge as the primary fuels for the brain, as they are capable of crossing the blood-brain barrier via endothelial cells and astrocytes [117]. The molecular mechanisms activated during periods of energy deprivation help delay the aging process and enhance the overall fitness of organisms.

During fasting, ketone bodies supply approximately 60% of the brain's energy, replacing glucose as the dominant source [118]. In neurodegenerative diseases such as Alzheimer's, Parkinson's, amyotrophic lateral sclerosis, frontotemporal dementia, and Huntington's disease, the severity of these conditions is partly attributed to glucose hypometabolism in affected regions [119–122]. The ketone bodies produced during fasting exert neuroprotective effects, mitigating neurodegeneration [123]. The most prevalent ketone body, β -hydroxybutyrate (BHB), inhibits inflammation in myeloid cells, thereby reducing age-related inflammatory responses. Ketone bodies are synthesized in the liver but are preserved for use by extrahepatic tissues, including the brain, heart, and skeletal muscle, conferring distinct health benefits. BHB produced by small intestinal stem cells maintains their "stemness" within crypts, enhancing tissue regeneration [124]. Moreover, ketones have been shown to regulate memory responses in CD8 T cells and control macrophage activation during acute pancreatitis [125]. BHB generated in renal epithelial cells mediates the protective effects of nicotinamide [126], and in cases of heart failure, an increased consumption of ketone bodies has been observed [127]. Furthermore, BHB functions as a histone deacetylase inhibitor, impacting gene expression [128]. Due to the wide range of actions of BHB, ketone bodies are considered crucial regulators of chronic inflammation associated with aging [129, 130], suggesting a complex relationship between fasting and immune system function.

Fasting Therapies

Fasting therapies have long-standing traditions across the globe, with fasting clinics, hospitals, retreats, and specialized departments focusing on the observed benefits of fasting in integrative medicine. Since their

introduction over a century ago by physicians like Buchinger [131], Krauss [132], and Mayr [133], fasting cures have gained popularity in Europe. Numerous beneficial effects of fasting have been reported in the treatment of chronic conditions, including metabolic disorders [134–136], pain syndromes [137–139], hypertension [140–142], chronic inflammatory diseases [43, 143], atopic conditions [144, 145], and psychosomatic disorders [146–148], with strong evidence supporting the use of fasting for rheumatic diseases [149–153]. Fasting is also considered an effective treatment for other conditions such as irritable bowel syndrome, food allergies, skin diseases, recurrent infections, asthma, inflammatory bowel disease, multiple sclerosis (MS), and various allergies [15]. Short-term fasting is reported to promote mental clarity and foster a more positive outlook on life, with some of these effects potentially attributed to neuroendocrine activation, contingent upon an individual's metabolic and endocrine status [137].

Analysis of Discussed Data:

There is substantial evidence supporting the beneficial effects of fasting. While many specific mechanisms remain poorly understood, animal studies have demonstrated lifelong benefits of intermittent fasting (IF). However, human studies have typically been of short duration, and the baseline characteristics of study populations have been highly variable [154–157]. In human trials, adherence to fasting patterns is often self-reported, which can introduce biases. The majority of clinical studies have focused on overweight individuals, necessitating further research to assess whether the benefits of IF extend to healthier, younger individuals. Additionally, the safety of fasting protocols must be thoroughly evaluated. Widely reported IF studies offer a unique opportunity to develop targeted therapeutic and pharmacological interventions for chronic diseases. It is important to recognize that no pharmaceutical medication can offer the broad spectrum of metabolic health benefits associated with IF. Alongside IF, other lifestyle strategies—such as regular physical activity, avoidance of alcohol, processed foods, and high-calorie diets—are essential for maintaining an active lifestyle. A diet based on low-calorie vegetables with adequate protein content is likely to provide substantial benefits, and addressing chronic diseases such as obesity is expected to significantly improve quality of life and potentially extend lifespan.

Despite the proven benefits, many individuals may struggle to maintain fasting regimes over extended periods, and in some cases, fasting may exacerbate eating disorders. Furthermore, individuals may experience a yo-yo effect, regaining weight after losing it through fasting. It is critical for fasting individuals to be monitored to ensure adequate fluid intake and electrolyte balance. Supervision is also essential in clinical settings, where patients may experience fatigue, nausea, and disrupted sleep patterns. Although fasting protocols have been consistently associated with health benefits, further research is necessary to quantify these benefits across large populations and specific human disease states. Additionally, it will be important to document the individual variations in responses to fasting among both human and animal populations.

Risks of IF:

While intermittent fasting (IF) offers various health benefits, it also carries some risks, particularly for individuals with cardiovascular disease. For instance, studies on rats subjected to alternate-day fasting (ADF) for six months showed reduced diastolic compliance and decreased cardiac reserve. Additionally, prolonged ADF, when combined with chemotherapy using doxorubicin, a cardiotoxic agent, led to worsened cardiac and skeletal muscle mass loss, resulting in cachexia and death. These adverse effects were linked to increased levels of a protein involved in muscle turnover. Interestingly, the same ADF regimen demonstrated beneficial effects in models of obesity, ischemia, and heart disease caused by protein aggregation. Therefore, further research is necessary to determine whether similar risks and benefits occur with other chemotherapy drugs or in conditions associated with muscle wasting.

While autophagy plays a key role in IF's effects, its impact on cardiac disease and aging remains debated. Autophagy may have opposing effects, either supporting disease progression or mitigating it, depending on the context and extent of its activation. Moreover, post-translational regulation of autophagy could enhance cardiac performance, while persistent activation of certain proteins may be harmful. While previous studies suggested that autophagy contributes to heart failure in stressed hearts, recent research has shown that

autophagy activation can prevent cardiac hypertrophy and improve diastolic function in aged hearts. However, the role of autophagy in aging cells is contentious, as excessive autophagy may lead to pathological consequences, including impaired blood vessel formation. In elderly individuals, reduced endothelial regeneration and the accumulation of senescent cells may limit the benefits of IF on vascular health.

Changes in blood pressure patterns are closely associated with cardiovascular risks, and altering meal timing through IF could impact the circadian regulation of blood pressure. This may be a particular concern for elderly individuals with hypertension or heart disease, as fluctuations in blood pressure could increase risks of orthostasis or falls. Additionally, metabolic changes induced by IF, such as electrolyte imbalances and activation of the sympathetic nervous system, could lead to dehydration and arrhythmias, especially in those with preexisting heart conditions. Therefore, due to the lack of sufficient data, implementing IF in older individuals or those with cardiovascular disease should be carefully considered, considering factors such as the specific fasting regimen, the person's cardiac health, comorbidities, age, and sex.

Conclusion:

Intermittent fasting (IF) has garnered significant interest as an effective strategy for improving health outcomes. The practice, which includes various time-restricted eating (TRE) protocols like the 5:2 diet, 16:8 method, and alternate-day fasting, has been shown to offer numerous benefits, particularly in metabolic health, weight management, and disease prevention. The growing body of evidence highlights that IF can help reduce body fat, improve insulin sensitivity, regulate blood pressure, and enhance lipid profiles, all of which contribute to better cardiovascular health and a reduced risk of chronic conditions such as diabetes, obesity, and hypertension. The molecular mechanisms driving these benefits are equally compelling. IF activates processes like autophagy, a cellular cleanup mechanism that supports tissue regeneration and homeostasis, while also improving mitochondrial function. These processes are crucial for maintaining cellular health, particularly as individuals age. Additionally, IF appears to regulate circadian rhythms, which influence metabolic pathways and energy balance, potentially optimizing the body's response to fasting and food intake cycles. Beyond metabolic health, IF has demonstrated potential in promoting longevity, enhancing immune function, and reducing inflammation, which are essential for aging and disease prevention. Studies also suggest that fasting may enhance the effectiveness of cancer therapies by inhibiting tumor growth and improving cellular responses to treatment. The regenerative properties of fasting, such as tissue repair and differentiation, contribute to the overall therapeutic potential of IF. While the current evidence is promising, further research, particularly long-term clinical trials, is needed to better understand the nuances of IF protocols. This includes examining the effects of different fasting regimens on diverse populations, including those with pre-existing conditions. Personalized approaches to fasting, taking into account individual health needs and lifestyle factors, may further optimize the benefits of IF. In summary, intermittent fasting holds considerable promise as a therapeutic tool, but more comprehensive studies are required to unlock its full potential and determine its long-term safety and efficacy.

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الصوم المتقطع وعلاقته بصحة الجسم - مراجعة محدثة

الملخص:

الخلفية: أصبح الصوم المتقطع (IF) والبروتوكولات المحددة بالوقت (TRE) شائعة لتعزيز الصحة، مع وجود أدلة تدعم فوائده مثل فقدان الوزن، تعزيز وظيفة المناعة، وتقليل المخاطر المرتبطة بأمراض مثل السكري، السرطان، وأمراض القلب والأوعية الدموية. وتسلط السياقات التاريخية والدينية للصوم الضوء على دوره الطويل في ثقافة البشر، بينما يستكشف البحث الحديث تأثيراته الأيضية، بما في ذلك تأثيره على حساسية الإنسولين، والالتهابات، والتمثيل الغذائي للدهون. تهدف هذه المراجعة إلى تحديث الفهم العلمي للصوم المتقطع وارتباطه بنتائج الصحة.

الهدف: تقييم العلاقة بين الصوم المتقطع وفوائد صحية متنوعة، مع التركيز على الصحة الأيضية، الشيخوخة، وظيفة المناعة، والوقاية من الأمراض. تهدف المراجعة إلى تسليط الضوء على الآليات التي يؤثر من خلالها الصوم المتقطع على الصحة واستكشاف فعالية البروتوكولات المختلفة للصوم.

الطرق: تراجع هذه المراجعة مجموعة واسعة من الدراسات، بما في ذلك نماذج الحيوانات، التجارب السريرية، والدراسات الجزيئية. يتم تحليل أنظمة الصوم المتقطع المختلفة مثل حمية 5:2، طريقة 16:8، والصوم المتقطع يومًا بعد يوم من حيث تأثيراتها على الصحة الأيضية، الشيخوخة، وظيفة القلب والأوعية الدموية، والوقاية من الأمراض. كما تأخذ المراجعة في الاعتبار الآليات الجزيئية التي تقف وراء هذه الفوائد مثل الالتهام الذاتي، وظيفة الميتوكوندريا، والإيقاعات اليومية.

النتائج: تشير الأبحاث إلى أن الصوم المتقطع يؤدي إلى فقدان الوزن، وتحسين حساسية الإنسولين، وتقليل ضغط الدم، وتحسين مستويات الدهون في الدم. وتشير الدراسات أيضًا إلى أن الصوم المتقطع قد يحمي من أمراض القلب والأوعية الدموية، ويبطئ عملية الشيخوخة، ويحسن استجابة المناعة. على الرغم من أن بعض النتائج قد تكون متغيرة، فقد أظهرت بروتوكولات مثل 16:8 آثارًا إيجابية على متلازمة الأيض، مما يقلل من المخاطر المرتبطة بالسكري، السمنة، وأمراض القلب. تشمل الآليات الجزيئية تحسين عمليات إصلاح الخلايا، الالتهام الذاتي، وتنظيم أفضل للإيقاعات اليومية.

الخلاصة: يظهر الصوم المتقطع كنهج واعد لتحسين الصحة العامة، مع فوائد كبيرة في الصحة الأيضية، إدارة الوزن، والوقاية من الأمراض. ومع ذلك، هناك حاجة إلى المزيد من الدراسات طويلة الأمد وواسعة النطاق لفهم التأثيرات التفاضلية لبروتوكولات الصوم المتقطع المختلفة. بالإضافة إلى ذلك، قد يعزز توقيت وجودة تناول الطعام، جنبًا إلى جنب مع النهج الشخصية، النتائج العلاجية للصوم المتقطع.

الكلمات المفتاحية: الصوم المتقطع، الأكل المحدد بالوقت، الصحة الأيضية، فقدان الوزن، الالتهام الذاتي، الإيقاعات اليومية، أمراض القلب والأوعية الدموية، وظيفة المناعة، الوقاية من السكري، الشيخوخة.