Review Article :

The Effectiveness of Intermittent Fasting on weight loss: A Systematic review

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Abstract

Weight loss is considered a key to end the obesity issue, which triggers many consequences that impair the state of health specifically. Many techniques can be applied to tackle and reduce the accumulated fat in the body. One known approach is Intermittent Fasting (IF) that can be performed through various methods. The objective of the protocol is to promote weight loss. This study is performed to examine the effectiveness of Intermittent Fasting on reducing the body mass index; therefore, lowering the risk of developing more health complications. To accomplish the analysis, a systematic review which focused specifically on randomized controlled trials studies was conducted through following the standard reporting guidelines outlined in the PRISMA statement. Nineteen studies were found relevant and were narratively synthesized and included in this study. All 19 intermittent fasting trials found a fat loss and a weight loss of 3% to 12.5% of baseline weight. The findings of two studies that examined intermittent fasting in Ramadan showed a positive impact of intermittent fasting on the body mass index while the two studies that combined intermittent fasting with exercise documented weight improvement and fat loss. Also, findings showed that an intermittent fasting approach may provide a significant benefit for insulin resistance. However, the time devoted in the previous experiments was insufficient to assess the effectiveness of the target technique. For this reason, it is significantly necessary to conduct long term duration and large population studies to completely analyse how effective the intermittent fasting is in weight loss.

Keywords:

Fasting, Intermittent fasting, Body mass index (BMI), Insulin sensitivity, Weight loss.

Key Points of The Study

Key point box:
• The intermittent fasting (IF) has always been considered a way to lose weight. • Previous Studies showed that IF has a significant effect on insulin sensitivity. • During Ramadan, the effect of IF is even more significant on fat loss. • Calories deficit and IF may be effective way to lose more fat. • Calories deficit and regular sports activity may be the key factors for weight loss.

Introduction:

Obesity is generally determined by a great amount of fat i.e. the body mass index (BMI) is equal to or exceeding 30 [1]. According to the World Health Organization (WHO), obesity represents 13% of the world's adult population [2]. The incidence of obesity differs from a nation to another. It represents less than 10% in Switzerland, Italy, Korea, and Japan, and about 42% in USA [1] while in the Kingdom of Saudi Arabia (KSA), 70% of people are experiencing this problem which is a major cause of concern [3]. Obesity is found a major source of other health issues related to high blood pressure, heart and blood vessels diseases, type 2 diabetes, sleep disorders, increased fats level; cholesterol and body joints damage [1]. Obesity rate continues to increase dramatically. According to a study conducted in KSA, obesity rate was of 29% (men: 24%; women: 33%) [1]. In an attempt to lessen its exacerbation, many interventions have been set. The most common one is dietary intervention which is the calorie-restricted (CR) diet. This intervention helps to achieve weight loss initially but there are many difficulties in sustaining daily calorie-restricted diet [4]. Therefore, an alternative intervention through intermittent fasting has been introduced. The intermittent fasting has an eating method which is constructed on either a small quantity of calories intake or their total omission. It lasts from 12 hours to several days with a determined plan[5]. It also has multiple methods and diets as the periodic fasting which means fasting for 1 or 2 days per week [6]. Another method is based on the fact of alternating fasting days, which means alternate between periods of regular eating and fasting6. The most common approach of intermittent fasting is the limited nutrition by daily time. According to which, one has a daily time limited space for food consumption such as (16:8 or 20:4 fasting); 16h refer to time of fasting and 8h is time for consuming food. Intermittent fasting has shown significant positive impact on insulin sensitivity and weight loss[7, 8]. Therefore, the objectives of this study were to examine (1) The effectiveness of intermittent fasting on weight and fat loss (2) The effectiveness of combining intermittent fasting with exercise on weight loss (3) The influence of insulin sensitivity by intermittent fasting (4) The effectiveness of intermittent fasting during Ramadan. This systematic review focused specifically on randomized controlled trial studies in addition to other references to support our results, and also to come out with clear conclusions and recommendations.

Methods and Search Strategy:

.Data Sources and Search Strategies

To facilitate the systematic review, various sources were checked to identify the relevant and appropriate literature. This included electronic databases investigation and relevant reference lists scrutiny. The accessed electronic databases comprised PubMed, Web of Science, Google Scholar, Scopus and J-Stage. The keywords commonly used for literature research of such topics include "intermittent fasting", "restricted fasting by time", "alternate fasting", "alternate day fasting", "meal frequency reduction", for intervention terms. Combination of the word "or" to the previous terms was made. Besides, the word "or" was combined with the terms "obese", "obesity" and "weight loss" as terms that serves the objectives. "And" was used to combine the two groups: "obesity" and "weight loss".

Study Selection

The review covered 2,715 records that resulted from consulting different databases, as the first approach used. Among the results, 1,324 duplicates that do not serve the aim were removed. The second approach was to search manually additional articles to detect more relevant literature that was not found in the first electronic searches. The review carried on with the assessment of titles and abstracts and ended with the exclusion of 1,023 works in addition to excluding 349 more inconvenient articles by the author of the running paper after a full text review. Following these exclusions, 19 articles remained (Figure 1).

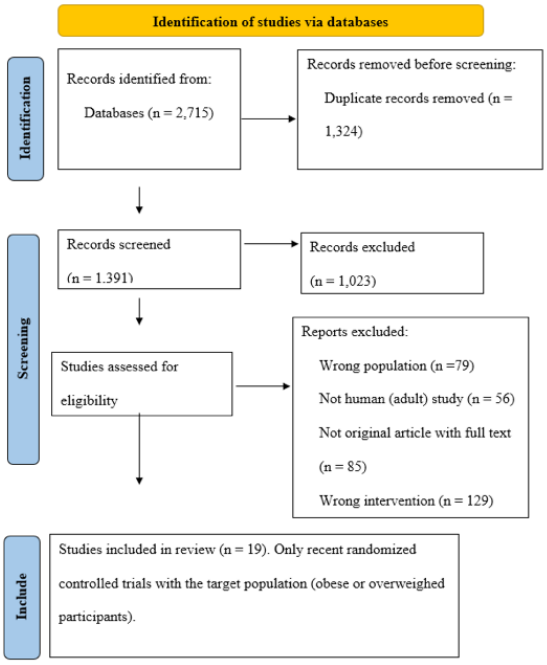


Figure 1. PRISMA Flowchart of the Study Selection According to The Study Design.

Nineteen articles addressed intermittent fasting and weight loss in overweight and obese people. Time devoted for the studies was often a short term (4 to 24 weeks) with a limited number of participants (9 to 250 members); five studies were one-year length. This work is a systematic review of literature and a descriptive based study that does not require an approval by the institutional review board or the informed consent. However, a check has been made to ensure that this work is original, as well as a registration in website "PROSPERO".

Suitability Standards

Inclusion

The standards of inclusion involved the research that presented mean ± standard deviation of the results. The research that focused on the efficiency of IF on weight loss for participants (obese or overweight people) with a BMI of (≥25 kg/m2) and aged >18 years. The research that was comparatively studied with control groups, in terms of normal diet with fasting or continuous controlled diet without fasting (12h) was also included. Currency and pertinence to the topic are the main standards that were considered during the examination and assessment of all research that were published between 2010 and 2021, in peer reviewed journal and in English language.

Exclusion

Exclusion meant the short-term research (<4 weeks) as well as the research performed on participants who required inpatient treatment and those with serious medical conditions such as seizures and stroke. The author excluded also researches on pregnant women and children. Editorials or case reports were not included either.

Results:

The results of our search are summarized in Table 1 to 4 as below.

Table 1: Summary of the Selected Studies to Assess the Effectiveness of Intermittent Fasting on Weight and Fat Loss.

Authors	Year	Target Population	Duration Weeks	Intervention (protocol)	Key findings and conclusions
Bowen et al.[10]	2018	Overweight and obese (n=162) RCT	16	3-d fast, 3-d CR, and 1-d ad libitum intake vs CR; 8-wk maintenance. self-reported	CR combined with IF does not improve on weight loss of CR alone
Catenacci et al.[8]	2016	Obese (n = 14) RCT	8	Alternated 0% usual calorie intake with ad libitum intake vs. CR; 24-wk follow-up; monitored	IF is a safe weight-loss strategy; no increase in the risk of weight regains
Domaszewski et al.[11]	2020	Overweight women over 60 years of age, (n = 45) (Experimental study)	6	Complete abstinence from food intake for 16 h per day, from 8 p.m. to 12 p.m. next day.	Bodyweight in the experimental group subjects decreased by almost 2 kg; this decrease was visible in the remaining parameters related to body fat mass.
Eshghinia and Gapparov [12]	2011	Obese women (n= 26) RCT	4	3-d fast (25% to 40% of usual caloric intake) and 4-d CR (10% decrease in usual caloric intake) per week. self-reported	Short-term IF with CR is a viable weight-loss strategy in obesity
Eshghinia and Mohammadzadeh[13]	2013	Obese women (n=15) RCT	6	3-d fast (25% to 30% of caloric needs), 3-d usual diet, and 1-d ad libitum intake; self-reported	Short-term IF is a viable weight-loss strategy in obesity
Gabel et al.[14]	2018	Obese (n=23) RCT	12	6-h fast daily vs. usual diet historical controls. self-reported	IF leads to weight loss compared with baseline and control group

Authors	Year	Target Population	Duration Weeks	Intervention (protocol)	Key findings and conclusions
Klempel et al.[20]	2013	Obese women (n=32) RCT	8	Alternated 25% of usual calorie intake with 125% of usual calorie intake; high fat vs. low-fat diet; self-reported	IF is effective for weight loss with high fat or low-fat diet composition
Moro et al.[21]	2016	34 males RCT	8	Time-restricted intermittent fasting	Fast mass decreases
Varady et al.[25]	2013	Obese (n=30) RCT	12	Alternated 25% of baseline energy needs with ad libitum caloric intake vs. usual diet. Monitored	IF is effective for weight loss in obese individuals
Zuo et al.[26]	2016	Obese (n=40), Experimental Design	12	1-d fast (430 kcal) and 6-d high-protein diet; 52-wk follow-up; monitored	IF with a high protein diet is effective for weight loss, with a low risk of weight regain

RCT (Randomized Controlled Trial), IF (Intermittent Fasting), CR (Calorie restriction)

Table 2: Summary of the Selected Studies to Assess the Effectiveness of Combining Intermittent

Authors	Year	Target Population	Duration (Weeks)	Intervention (protocol)	Key findings and conclusions
Bhutani et al.[9]	2013	Obese, 80 women, three men, RCT	12	Alternate day modified fasting (ADMF) + exercise	Bodyweight was reduced (P < 0.05) by 6 6 4 kg, 3 6 1 kg, and 1 6 0 kg in the combination, ADF, and exercise groups, respectively.
Hottenerott et al.[17]	2020	Overweight (n = 80), RCT	12	Alternate day fasting	Significant effect on body weight when combining IF with exercise
Jospe et al.[19]	2020	Overweight (n=250) RCT	52	55% of participants chose IF, 27.2% chose Mediterranean diet, 35% chose Paleo	Weight loss was higher in the IF group

Table 3: Summary of the Selected Studies to Assess the Influence of Insulin Sensitivity by Intermittent Fasting

Authors	Year	Target Population	Duration (Weeks)	Intervention (protocol)	Key findings and conclusions
Harvie et al.[15]	2011	Obese women (n=107) RCT	24	2-d fast (very low-calorie intake) and 5-d usual diet vs. CR; self-reported	IF is as effective as CR for weight loss and insulin sensitivity
Hoddy et al.[16]	2016	Obese non-diabetic adults (n = 54)	8	Alternated daily 25% of baseline caloric needs with ad libitum caloric intake; self-reported	IF is a safe weight-loss strategy; no increased risk of disordered eating; might decrease insulin resistance
Hutchison et al. [18]	2019	Overweight and obese women (n=88), RCT	8	3-d fast (32%-37% of energy requirements) and 4 d at 100% or 145% of energy requirements vs. CR and control group; self-reported	Combining calorie-restricted diet and IF is more effective for weight loss than either alone
Praestya et al.[22]	2021	27 males RCT	4	Ramadan IF	Intermittent fasting during Ramadan leads to beneficial effects on weight loss and insulin sensitivity

Table 4: Summary of the Selected Studies to Assess the effectiveness of Intermittent Fasting during Ramadan.

Authors	Year	Target Population	Duration (Weeks)	Intervention (protocol)	Key findings and conclusions
Praestya et al.[22]	2021	27 males RCT	4	Ramadan IF	Intermittent fasting during Ramadan leads to beneficial effects on weight loss and insulin sensitivity
Sana et al.[23]	2017	9 males (Experimental design)	4	Ramadan IF	Intermittent fasting during Ramadan reduced body mass index
Teng et al.[24]	2013	Men aged 50-70 years (n=56) RCT	12	Baseline energy intake combined with two days of Muslim Sunnah fasting per week	A significant interaction effect was found in body weight reduction and fat percentage.

Effectiveness of Intermittent Fasting on Weight and Fat Loss

The intermittent fasting (IF) has often been associated with a drastic decrease in the body weight. The topic of its influence on the body mass has been subject of examination by all the nineteen selected studies. The latter's results showed that intermittent fasting is considered as a significant factor in obesit [8, 13, 14]. The studies' intervention periods ranged from 4 to 48 weeks. In all studies (n = 1,175), participants who used intermittent fasting method have weight loss results. The effects ranged from 3 % to 12.5% of both the baseline body weight and the significant fat loss[24, 26]. The influence occurred even though there was a difference in the total caloric intake. Among the studies were two studies that investigated Ramadan fasting for a duration of 4 weeks[22, 23] there were also studies longer than 6 weeks, which showed waist decrease estimated by 4 to 9 cm. Another study showed that 80% of the weight loss with intermittent fasting was a fat loss[15]. IF effectiveness is demonstrated, as well, in the 16 hours daily fast which appears to be the most appropriate and the most effective on body weight. Studies showed that participants could maintain at least 16 hours of daily fast, with an eating window of 8-hour each day. According to Arnason et al 2017, participants set a goal of at least 18 hour fast, but they could fast for only an average of 16 hours a day[27].

Effectiveness of Combining Intermittent Fasting with Exercise on Weight Loss

Combining Intermittent fasting with the physical exercise is thought to boost weight loss. Only two studies investigated this claim. They assessed intermittent fasting intervention with exercise, which was equally performed in the control group. Combining the two techniques can produce

superior and notable changes in weight loss as well as decreasing fat mass and waist circumference. Findings of the first study conducted by Bhutani et al 2013, has demonstrated weight loss improvement in 64 obese participants who combined intermittent fasting and exercise. The weight loss for those participants has increased considerably (about 6 kg) when exercise was added to IF9. The second study performed by Hottenrott et al 2020 to assess the same question, reported that exercise in combination with intermittent fasting is an effective approach to weight loss and body fat loss [17].

The Influence of Insulin Sensitivity by Intermittent Fasting

The question about what effects an intermittent fasting has on insulin sensitivity was answered by four studies that reported its interesting effectiveness[22]. A study conducted by Harvie et al 2011 confirmed a significant improvement and reduction in insulin sensitivity after 6 months intervention[15]. Another study conducted to testify to the efficiency of the target approach on the insulin sensitivity reported a decrease in insulin resistance among participants with intervention of 8 weeks[16]. A time restricted fasting of 24 hours fast has shown improvement of insulin resistance of the participants (n = 88) with intervention of 8 weeks18. In conclusion, the four studies confirmed the effectiveness of IF on improving and treating insulin sensitivity.

Ramadan

Among the nineteen selected studies in this review, two studies investigated Ramadan fasting. Ramadan is a culturally specific occasion that represents a good example of intermittent fasting for Muslims. During this occasion, the fast begins at sunrise and ends at sunset 28. Generally, individuals who fast often do it for about 15 hours a day for 29 or 30 days, which is a real opportunity to study the effects of fasting. Only one of these studies included a control diet group [23]. Ramadan studies examined weight loss (n=36) and resulted in the weight reduction that varied between 0.1 kg to 2 kg [22, 23]. Results from the two studies of Ramadan IF demonstrated a positive effect on both weight and fat loss.

Adverse Event

No serious incident was reported in the selected studies about intermittent fasting. Concerns about the safety of fasting include side effects related to mood and bingeing, among others. Overweight individuals reported improved body shape and less depression. In a study conducted by Harvie et al 2011, more than 30% of the participants reported an increase in self-confidence and positive mood, in addi-

tion to less depression. Further, the Study participants, on one hand, occasionally reported some symptoms such as dizziness, general weakness, bad breath, headache, feeling cold, concentration issues, sleep disturbance, nausea and constipation [15]. When compared with baseline, these signs had been unchanged with fasting. On the other hand, during the first week of the trial two participants reported mild headaches, which may or may not be related to the dietary treatment [25]. Also, another participant reported constipation during the first and the second week of the trial. The constipation subsided in the third week of the intervention period after giving the recommendation of consuming more vegetables and fruits.

Discussion

This review sought to examine the effectiveness of intermittent fasting approaches on body reduction. Recently, Intermittent Fasting has gained popularity as a substitutional approach for weight decrease management. Considering the ambiguity of the IF impact on weight loss and insulin sensitivity and the lack of evidence in meta-analysis, the author conducted this systematic review and selected 19 studies. Articles included in this review that adopted the alternate day fasting with a degree of calorie restricted diet resulted in a significant reduction in body weight [12, 15, 18]. However, studies which adopted time restricted fasting with a small degree of calorie restricted diet has a smaller (<0.5 kg) weight reduction [11, 21]. In a study conducted to assess the impact of alternate day fasting on weight reduction for duration of 12 weeks, indicated that the body weight of participants has reduced 6% (5kg) by the end of the trial [25]. Therefore, alternate day fasting could produce a rate of weight reduction of 0.6kg/week [19, 24]. In addition, studies that adopted the fasting time but maintained the total calorie intake showed no meaningful weight decrease [11, 21]. In fact, calorie restricted diet and exercise are considered as key factors that affect weight loss [29]. Therefore, combining intermittent fasting and reduction in the total calories consumed is considered as an effective approach to achieve weight loss [20].

The effectiveness of intermittent fasting on insulin sensitivity in the previous studies has been shown through reductions in body weight and body fat [30]. Insulin sensitivity improvement was suggested by the insulin reduction after a day of fasting [31]. Studies also discussed, through comparison to the baseline, the change that an alternate day fasting for 12h can do to insulin. Their findings showed no significant change on fasting insulin [32, 33]. Therefore, to realize an interesting effect on insulin ,

people may need to fast for more than 12h for a long term [32].

Results of this study showed that Ramadan intermittent fasting elicits and leads to highly significant reductions in body mass index [34]. The results also suggested that in Ramadan IF, weight loss seemed to be more efficient in adults with higher BMI values. The great loss of body fluids in obese adults during intermittent fasting in Ramadan provides a likely explanation for such relationships [34]. However, even though IF during Ramadan is an important opportunity for some obese/overweight to lose weight, the adaptations inherent to Ramadan intermittent fasting are typically transient and largely reversible within a small amount of time but of extreme value for the long-term preservation of body composition.

Exhibition of The Review's Strengths and Limitations

Strengths of this study are multiple: First, during first stages of realizing this review, the PRISMA statement guidelines were abided by. This was a pavement to have a robust process. In addition, to ensuring a thorough exploration of knowledge about the effect of intermittent fasting on weight loss. Second, the individuals involved in this study represent the general population with a wide BMI evidence. Thus, this confirms the effectiveness of IF on the general population with a fit health status (without comorbidities). The result expressed an amelioration in the body fat distribution during an intermittent fasting; nevertheless, further studies are indispensable to clarify the benefits of this approach. These strong aspects in the study make it of high value but this is not to claim it is limitations free.

Undoubtedly, this study had some limitations. First, the review found restriction at the level of the participants' number that was insufficient to get a wide range of data. Moreover, the intervention duration was limited to a short term of 4 to 24 weeks only. This might limit the expected long-term effects of intermittent fasting and their findings' generalizability. Second, only studies with mean and SD were selected. Third, inclusion criteria for this study were adult with no chronic diseases which make it difficult to determine the effectiveness of intermittent fasting in people with chronic diseases such as cardiovascular, especially in times of pandemic crisis. Regarding the demographic data of participants, there are numerous studies, which are incomplete. The fact that did not enable the author to conduct further analysis.

Conclusions

In conclusion, intermittent fasting is found

effective in reducing obesity. Its effectiveness is strengthened when combined with regular sports activity which makes it more effective and capable of leading to more weight loss compared to a normal diet with exercise program. The diversity / heterogeneity of the existing data creates limitation of comparison of intermittent fasting to other weight-loss strategies. Intermittent fasting is claimed to be one of the treatments for obesity in spite of the narrow knowledge about its long-term effects on health. Perspectives of long-term studies are significantly necessary to understand the underlying mechanisms of intermittent fasting, specifically how it might contribute to effective weight-loss approaches. Moreover, Further studies should indubitably assess the impact of IF using larger samples of older people over a longer period of time and a more heterogeneous population for a better examination of the impact of this promising IF intervention especially in this high-risk population.

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