

EFFECT OF INTERMITTENT FASTING ON WEIGHT LOSS AND MAINTENANCE OF THE LOST WEIGHT IN OVERWEIGHT AND OBESE INDIVIDUALS (A SYSTEMATIC REVIEW AND META-ANALYSIS)

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ABSTRACT:

Background: Long-term continuous caloric restriction (CCR) has demonstrated efficacy in reducing body weight in obese individuals. Adhering to daily CCR proves to be challenging in practical situations. Recent research suggests that intermittent fasting (IF) could enhance adherence to dietary restrictions.

Aim of the Study: The aim of this meta-analysis was to investigate the impact of IF interventions in comparison to the conventional CCR on weight loss and the sustenance of lost weight among overweight or obese individuals.

Methods: Comprehensive search was conducted in the PubMed, Web of Science, Scopus and Cochrane Central Register of Controlled Trials databases. After removing duplicates, we excluded studies that did not have a randomized controlled design, studies involving animals or individuals under eighteen years, and studies published in languages other than English. The final included studies were 12 randomized controlled clinical trials (RCTs).

Results: Among the 12 studies, only one demonstrated a noteworthy reduction in body weight (BW) with the IF protocol compared to CCR. No significant differences were observed in terms of body mass index (BMI) reduction or waist circumference (WC) reduction across the studies. IF exhibited significantly better results of weight loss maintenance (WLM) in only one study.

Conclusion: IF and CCR demonstrate similar reductions in BW, BMI, and WC. IF emerges as an appealing alternative to traditional CCR for weight control. WLM remains underexplored and necessitates dedicated RCTs. Larger clinical trials are essential to determine whether certain individuals respond more favorably to IF compared to CCR.

Keywords: Intermittent fasting, Meta-analysis, Continuous Caloric Restriction, weight loss maintenance, Ain Shams University.

INTRODUCTION:

Worldwide, obesity is associated with metabolic dysregulation, including insulin resistance, hypertension, dyslipidemia, and atherosclerosis, which presents a risk to public health⁽¹⁾. The cornerstone of treating

obesity and the metabolic risk factors that go along with it is calorie restriction (CR) without starvation. Prolonged CCR is known to lower body weight and increase longevity⁽²⁾. On the other hand, sustained daily CR is challenging to sustain in real

life⁽³⁾. Many studies conducted recently have suggested that intermittent fasting (IF) may enhance dietary adherence. IF has become an acceptable alternative to extended CR, offering comparable advantages in terms of controlling chronic illnesses and reducing body weight⁽⁴⁾. Despite its growing popularity among patients, the literature is still contradictory because of many ambiguous points about IF. Firstly, the term "IF" is defined differently by different people. Most of the research began with investigating the results of Ramadan religious fasting. Later, more protocols came out, most of which focused on the 5:2 diet, which is defined as designating two days per week as "fasting" days and implementing alternate-day caloric restriction on days that are designated as "feed"⁽⁵⁾.

The main mechanism that underlies the health benefits of IF is weight loss. According to the results of CR, losing weight lowers body inflammatory status and risk factors for cardiovascular disease by controlling metabolic signaling pathways, such as those involving autophagy and AMP-activated protein kinase (AMPK)⁽³⁾. IF has positive impacts on physiological processes; nevertheless, several patients involved in IF trials had decreases in lean body mass and bone density⁽⁶⁾.

As previously mentioned, CR has long been used as the main treatment option for obesity; however, in recent times, dieters began to substitute IF for CR as a more acceptable dietary approach⁽⁴⁾. A previous clinical trial indicated that IF causes 4%–10% decrease in body weight in overweight people⁽⁷⁾. Most of the research comparing CR and IF in overweight or obese individuals has demonstrated comparable results in terms of reductions in body weight and fat mass after IF or CCR in overweight or obese individuals⁽⁸⁾. According to a recent study, among patients with complicated obesity, IF may be linked to a higher rate of weight regain after the 6-month weight reduction phase

ends than CCR⁽⁹⁾. To evaluate the possibility of losing weight without gaining it back, more research is required.

AIM OF THE STUDY:

The aim of the current systematic review and meta-analysis was to find out the effect of IF interventions compared to regular form of continuous caloric restriction on weight loss and maintenance of the lost weight in overweight and obese individuals.

METHODOLOGY:

Materials and methods:

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines were followed throughout the design, implementation, and analysis of this study⁽¹⁶⁾.

1. Search strategy:

The intended purpose of the search technique was to identify RCTs comparing the usual type of calorie restriction to IF as a means of weight-loss intervention. Without any time, constraints, a search was conducted in the PubMed, Web of Science, Scopus and Cochrane Central Register of Controlled Trials databases.

The Subsequent Search Term Was Utilized:

[(Fasting OR "Time Restricted" OR "Calorie* Restricted" OR "Low Calorie*" OR Low-Calorie*) AND (weight OR obesity*) AND (clinical trial [Filter])].

These types of studies were excluded:

- a. studies without IF as a component of the intervention.
- b. intervention studies lacking a randomized controlled design.
- c. studies involving animals or children under the age of 18.

d. studies published in languages other than English.

2. Selection procedure:

After removing the duplicate studies, a first selection was conducted by checking the title and abstract of each article. Based on the previously mentioned criteria, studies were categorized as either "excluded" or "included" for reading the full text by two independent reviewers. A full text screening of 200 studies was conducted. In the end, 12 studies were chosen to form part of the final analysis Figure (1).

3.Data extraction:

The parameters of the sample [number of participants in each group, mean age, body weight, BMI, waist circumference (WC)], the nature and characteristics of the intervention, and the study variables were identified in an extraction table that was developed to identify the aspects of the studies that were ultimately selected. Documentation of compliance, follow-up, and weight maintenance were also done.

4. Statistical analyses:

A forest plot was then constructed, encompassing all the data for every outcome. For each outcome, the mean difference (MD) with 95% confidence interval (CI) was determined. I² statistics were used to measure heterogeneity. Results of random-effects model were presented, since a random-effects model is more dependable than a fixed-effect model in situations where the number and size of component studies are limited. Review Manager 5.3.5 was used for all analyses (The Cochrane Collaboration, 2014).

Ethical consideration

The study was approved by the institution review board and the ethics committee of the Faculty of Medicine, Ain Shams University. The approval number is (FWA000017585).

RESULTS:

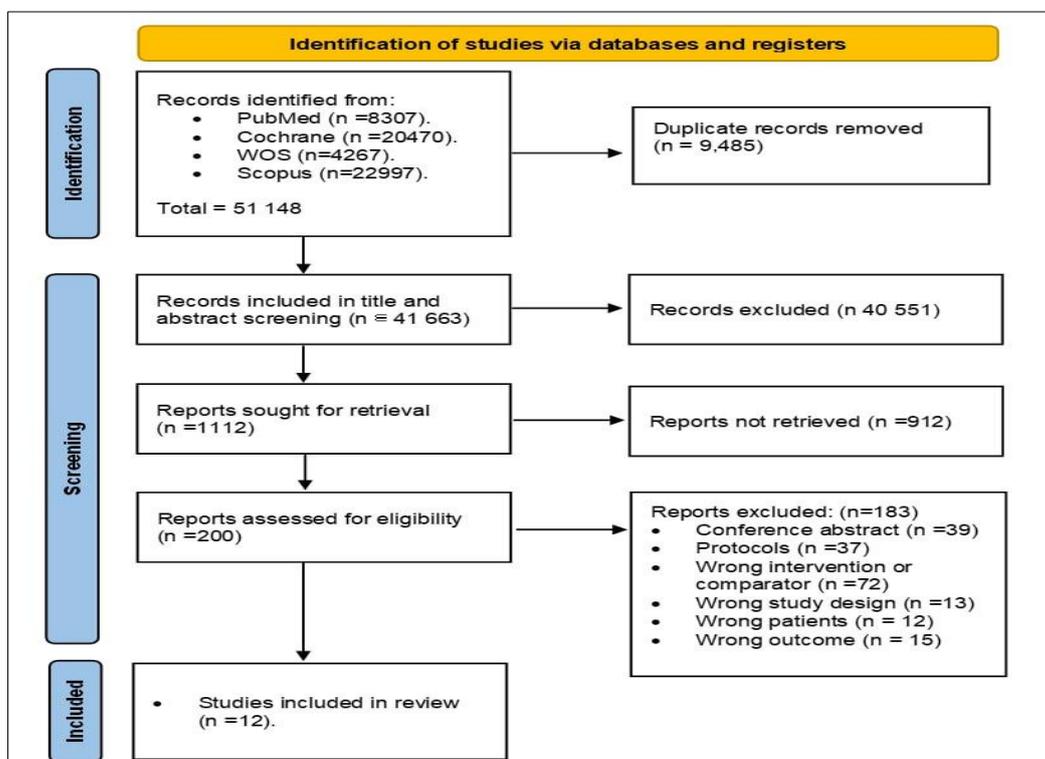


Figure 1: PRISMA flow chart of the methodology for the search results.

Figure (1) shows the initial literature search identified records, after removing duplicates, screened, and number of studies after excluding articles not meeting the inclusion criteria, 200 records were assessed for eligibility. After further analysis, a total of 12 studies were selected for the systematic review and meta-analysis.

Table (1) shows characteristics of included studies. All studies had a comparator

of standard continuous calorie restriction. The intervention lasted between 4 weeks and 12 months in Wei and collaborators (2023). Five studies out of 12 did not follow up their groups of intervention or the comparator. IF showed significantly better maintenance of weight loss in only one study, while no follow up was done in 5 studies and no significant difference was found in the other 6 studies regarding the maintenance point.

Table 1: Summary of characteristics of included studies.

Author	Setting	Sample size			Intervention	Comparator	Duration of intervention or follow up	Follow up points	Drop-out rate	Main authors' conclusion
		total	Intervention	Comparator						
Byrne et al. 2018 ⁽¹⁰⁾	Australia	51	26	25	Intermittent Calorie Restriction	Continuous Calorie Restriction	The total length of the intervention was 28 and 42 weeks. Then participants were followed up after a 6-month free-living period	after 16 weeks of intervention and after 6 months of follow up	6 (12.8%)	Individual differences existed in weight re-gain during the 6-month post-intervention period. While both groups on average gained weight back throughout the 6-month follow-up (P = 0.24), the INT group continued to lose more overall weight from the end of baseline (P = 0.001).
Carter et al. 2016 ⁽¹¹⁾	Australia	63	31	32	Intermittent Calorie Restriction	Continuous Calorie Restriction	the diet lasted for 12 weeks	the outcome was assessed at week 12.	-	No follow up done
Carter et al. 2019 ⁽¹²⁾	Australia	137	70	67	Intermittent Calorie Restriction	Continuous Calorie Restriction	the diet lasted for 12 months then followed till 24 months	the outcome was assessed at 24 months.	53(38.7%)	Weight loss was maintained (P < 0.001) in both groups at 24 months, with no between-group difference
Conley et al. 2018 ⁽¹³⁾	Australia	24	12	12	Intermittent Calorie Restriction	Standard Calorie-Restricted Diet	the diet lasted for 6 months	the outcomes were measured at 3 and 6 months	1 (4.2%)	Weight loss was maintained in both groups at 6 months, with no between-group difference
Coutinho et al. 2018 ⁽¹⁴⁾	Norway	35	18	17	Intermittent Calorie Restriction	Continuous Calorie Restriction	the diet lasted for 12 weeks	the outcomes were measured at week 12.	-	No follow up done
Kim et al. 2020 ⁽¹⁵⁾	London	45	23	22	Intermittent Calorie Restriction	Continuous Calorie Restriction	the diet lasted for 4 weeks	the outcome was measured at the day 31	-	No follow up done

Effect of Intermittent Fasting on Weight Loss and its maintenance

Maroofi et al. 2020 ⁽¹⁶⁾	Iran	88	44	44	Intermittent Calorie Restriction	Continuous Calorie Restriction	the diet lasted for 8 weeks	The outcomes were measured at week 8	-	No follow up done
Schubel et al. 2018 ⁽¹⁷⁾	Germany	150	49	49	Intermittent Calorie Restriction	Continuous Calorie Restriction	The participants follow 12 weeks of intervention followed by a 12-week maintenance, and 26 weeks then follow up phase	The outcome was measured at week 12 after the intervention and at week 24 after maintenance.	9.30%	Weight loss was maintained in both groups at 50 weeks, with no between-group difference
									No drop-out reported in follow up phase	No within-group changes were observed during weight loss maintenance for anthropometry
Steger et al. 2022 ⁽¹⁸⁾	greater Kansas City	35	18	17	Intermittent Calorie Restriction	Continuous Calorie Restriction	The participants follow 12 weeks of intervention followed by a 12-week maintenance	The outcome was measured at week 12 after the intervention and at week 24 after maintenance.	7 (6.25%)	Both groups-maintained weight loss in the maintenance phase with no between group differences
Sundfor et al. 2018 ⁽¹⁹⁾	Norway	112	54	58	Intermittent Calorie Restriction	Continuous Calorie Restriction	The participants follow 6 months of intervention followed by a 6-month maintenance	the outcomes were measured at 3 and 6 months	75 (34.4%)	Weight loss maintenance at month 18 did not differ between iTRE and CR, suggesting that neither regimen was more sustainable when support from the investigators was withdrawn
Teong et al. 2023 ⁽²⁰⁾	Australia	209	85	83	Intermittent Calorie Restriction	Continuous Calorie Restriction	The participants follow 6 months of intervention followed by 12 months of follow up	The outcomes were measured at 6 and 18 months	-	No follow up done
Wei et al. 2023 ⁽²¹⁾	China	88	45	43	Time-Restricted Eating	Daily Calorie Restriction	The diet lasted for 12 months	The outcomes were measured at 6 and 12 months	14 (15.9%)	"During the 12-month intervention, body weight was significantly reduced in the TRE group and in the DCR group, with no significant between-group differences "

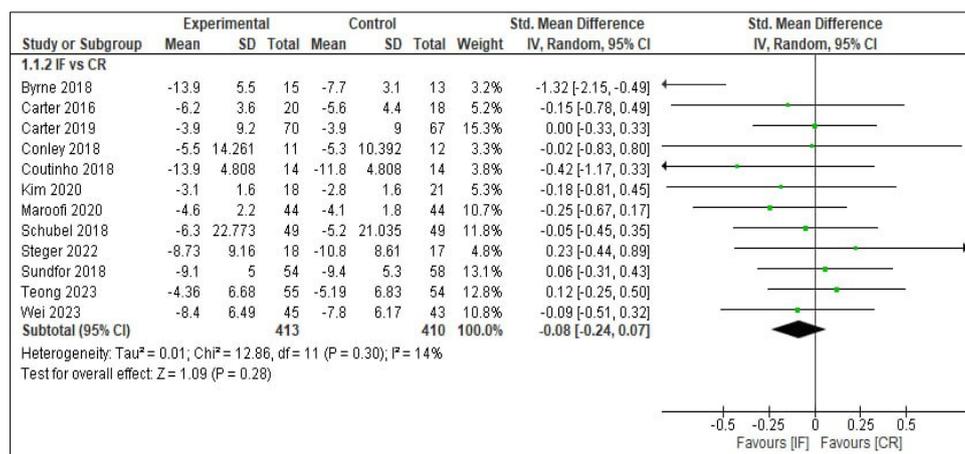


Figure 2: Forest plot comparing IF and CCR regarding Body Weight (BW)

Figure (2) shows that no significant differences regarding weight loss in any of the included study except in Byrne and

collaborators (2018) which showed favorable results towards IF but no significant difference in the pooled effect.

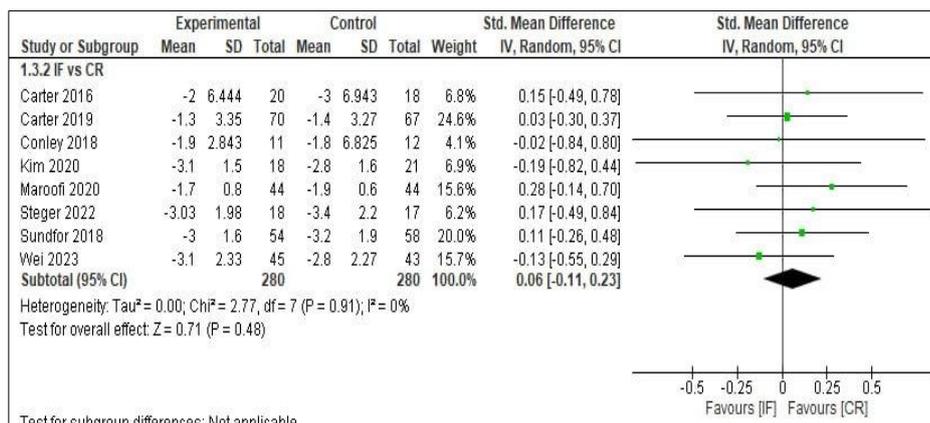


Figure 3: Forest plot comparing IF and CCR regarding Body Mass Index (BMI)

Figure (3) shows that no significant differences were detected regarding BMI in any of the included studies as well as the pooled effect.

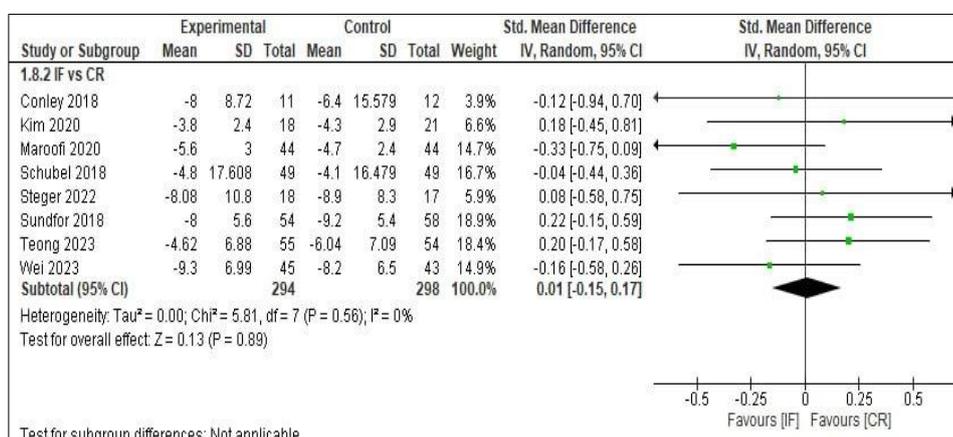


Figure 4: Forest plot comparing IF and CCR regarding Waist Circumference (WC)

Figure (4) shows that no significant differences were detected regarding WC in any of the included studies nor in the pooled effect.

Regarding maintenance of the lost weight IF showed significantly better maintenance of weight loss in only one study, while no follow up was done in 5 studies and no significant difference was found in the other 6 studies regarding the maintenance phase Table (1).

DISCUSSION:

The purpose of this systematic review was to evaluate the effectiveness of IF as a weight control strategy against CCR. The

main findings of the meta-analysis showed that IF is equally effective as CCR for weight loss, lowering BMI and WC reduction based on the available data. Both interventions produced a similar and substantial weight reduction in only one study of Byrne and collaborators⁽¹⁰⁾ out of 12 studies showing significant reduction in the IF group. Similarly, the same study found significantly better weight loss maintenance than the CCR group. The other 11 studies either didn't follow up their groups or didn't find a significantly better maintenance in any of the groups over the other during follow up.

The similarity between both interventions in weight loss agrees with Harris and collaborators' meta-analysis⁽⁵⁾.

They included only 4 studies in their meta-analysis and interpreted their results with extreme caution. Rynders and collaborators' meta-analysis⁽⁹⁾ done in 2019 including 11 studies found the same finding of the current study. Cioffi and collaborators⁽²²⁾ conducted a meta-analysis in 2018 revealed a comparable effect of both interventions regarding body anthropometry. IF had a slightly better metabolic outcome than CCR, however they interpreted this result as being uncertain.

On the other hand, Morales-Suarez-Varela and collaborators⁽²³⁾ conducted a systematic review in 2021 and found a significant reduction in WC than the CCR group. It is worth mentioning that Morales-Suarez-Varela and collaborators included 16 review articles in their systematic review in addition to RCTs which may explain the difference from the current study results. Zhang and collaborators⁽²⁴⁾ also found that the body weight change was more significant after IF than CCR ($p=0.028$). This difference may be due to the difference in search term used by Zhang. They included search words expressing possible metabolic effect of IF. This may lead to differing search results and different analysis.

Regarding weight loss maintenance IF showed significantly better maintenance of weight loss in only one study Byrne et al. 2018⁽¹⁰⁾, while no follow up was done in 5 studies and no significant difference was found in the other 6 studies regarding the maintenance point. This indicates insufficient coverage of this point. State of physical activity, form of follow up whether with a dietitian or not and the intervals employed were rarely mentioned. Longer durations of follow up with clear protocols are needed in different or separate RCTs.

In real life situations, people living with overweight/ obesity may find it difficult to follow CCR protocols for long periods. IF may provide a good and more tolerable alternative for them to follow. Larger sample sizes and studies of prolonged duration are

needed to comprehend the possible long-term impacts on macro- and micronutrient deficiencies that could result from long term IF and how those deficiencies would affect a person's health.

Limitations of study: IF protocols utilized in each trial were not categorized in the current analysis, which makes it challenging to determine how different IF procedures affect weight and body anthropometry. Variation in intervention durations across the included studies which may introduce heterogeneity in the data, as effect estimate may vary over time.

Conclusion: IF and CCR demonstrate similar reductions in body weight, BMI, and WC. IF is regarded as a feasible and appealing alternative to traditional calorie restriction for weight and metabolic control, given its structured approach to caloric restriction within specific timeframes. However, additional RCTs are necessary to investigate the long-term application of IF and its potential effects and side effects over extended durations. Weight loss maintenance is an area that requires separate RCTs as it has not been thoroughly studied.

Recommendations: A precise definition of what IF is, really must be established as IF grows in popularity. It is still necessary to find out if "IF" affects body composition or metabolic parameters even while IF does not result in more weight reduction than CCR. Studies' power to identify variations in these results has been insufficient. Larger clinical trials will also be essential to see if it is possible to anticipate which patients will respond best to IF compared to CCR.

Funding:

No fund was received for this research work.

Conflicts of interest:

None.

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تأثير الصيام المتقطع على إنقاص الوزن والمحافظة عليه لدى الأشخاص الذين يعانون من زيادة الوزن أو السمنة (مراجعة وتحليل منهجي للأبحاث المنشورة سابقا)

آيات فاروق محمد منظور ودينا نبيه كامل بولس و وليد صلاح الدين ومحمد فاروق علام

قسم طب المجتمع والبيئة وطب الصناعات - كلية الطب جامعة عين شمس

المقدمة: ترتبط السمنة بالعديد من المخاطر الصحية، مثل مقاومة الأنسولين وارتفاع ضغط الدم واضطراب مستوى الدهون بالدم. لقد أظهر نظام تقليل السرعات الحرارية المستمر على المدى الطويل (CCR) أنه يقلل من وزن الجسم. ومع ذلك، يصعب الحفاظ على هذا النظام بشكل يومي. أشارت الدراسات الحديثة إلى أن الصيام المتقطع (IF) قد يحسن الالتزام بالنظام الغذائي. **الهدف:** كان الهدف من هذا التحليل التلوي هو معرفة تأثير تدخل الصيام المتقطع (IF) مقارنة بنظام تقليل السرعات الحرارية المستمر (CCR) على فقدان الوزن والحفاظ على الوزن المفقود لدى الأفراد الذين يعانون من زيادة الوزن والسمنة.

طرق الدراسة: تم إجراء بحث في قواعد بيانات PubMed، و Web of Science، و Scopus، و Cochrane Central Register. بعد إزالة الدراسات المكررة، استبعدنا الدراسات التي تفتقر إلى التصميم العشوائي، والدراسات التي تشمل الحيوانات أو الأطفال دون سن الثامنة عشرة؛ والدراسات المنشورة بلغات أخرى غير الإنجليزية. وكانت الدراسات النهائية المشمولة هي اثنتي عشرة تجربة عشوائية.

النتائج: أظهرت دراسة واحدة فقط من أصل 12 دراسة انخفاضاً ذو دلالة إحصائية في وزن الجسم باستخدام بروتوكول الصيام المتقطع مقارنةً بتقليل السرعات الحرارية المستمر، لم يتم العثور على فروق ذات دلالة إحصائية فيما يتعلق بتخفيض مؤشر كتلة الجسم (BMI)، وانخفاض محيط الخصر (WC) فيما يتعلق بالحفاظ على الوزن المفقود، أظهرت دراسة واحدة فقط الحفاظ على فقدان الوزن بشكل ذو دلالة إحصائية مع نظام الصيام المتقطع. لم يتم إجراء أي متابعة في 5 دراسات ولم يتم العثور على فرق ذو دلالة إحصائية في الدراسات الست الأخرى حيث تم إجراء المتابعة.

الخلاصة: أظهرت الدراسة أن نظام "تقليل السرعات الحرارية المستمر على المدى الطويل" و نظام "الصيام المتقطع" لديهم تخفيضات متماثلة لوزن الجسم، ومؤشر كتلة الجسم ومحيط الخصر. يعتبر الصيام المتقطع بديلاً جيداً وممكنًا لتقليل السرعات الحرارية للتحكم في الوزن. عادة لا تتم متابعة الحالات و دراسة الحفاظ على الوزن المفقود بشكل جيد وتحتاج إلى دراسات تدخلية منفصلة. من المرشح و المطلوب زيادة عدد الدراسات لمعرفة مدى تحمل الأشخاص زائدي الوزن لهذه الأنظمة على المدى الطويل.