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Time restricted feeding as an alternative dietary strategy in obesity

Alimentación restringida en el tiempo como estrategia alternativa en la obesidad

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ABSTRACT

Obesity, according to WHO ICD-11, is a chronic multifactorial disease characterized by excessive adiposity that impairs health. It is a growing global problem, with a prevalence of 44% in adults in 2022. In Spain, obesity affects 16.5% of men and 15.5% of women over 18 years of age. Dietary and nutritional strategies for its treatment include calorie restriction, intermittent fasting and time-restricted feeding (ART), which aligns intake with circadian cycles, showing benefits in reducing body weight. Recent studies highlight ART as effective, although the evidence is mixed.Time criteria (maximum 5 years old) and type of intervention (clinical trials) were determined for the search and literature review of scientific evidence related to time-restricted feeding and its impact on obesity. Pubmed was the main database used, from which a total of 13 clinical trials were analyzed in detail. Time-restricted feeding is a good alternative strategy for the treatment of obesity.

Palabras clave:
Alimentación en tiempo restringido, obesidad, crono nutrición, ayuno, pérdida de peso, restricción calórica.

RESUMEN

La obesidad, según la CIE-11 de la OMS, es una enfermedad crónica multifactorial caracterizada por adiposidad excesiva que perjudica la salud. Es un problema global en aumento, con prevalencia de 44% en adultos en 2022. En España, la obesidad afecta a 16,5% de hombres y 15,5% de mujeres mayores de 18 años. Las estrategias dietético-nutricionales para su tratamiento incluyen la restricción calórica, el ayuno intermitente y la alimentación restringida en el tiempo (ART), que alinea la ingesta con los ciclos circadianos, mostrando beneficios en la reducción del peso corporal. Estudios recientes destacan la ART como efectiva, aunque la evidencia es variada. Se determinaron criterios temporales (máximo 5 años de antigüedad) y de tipo de intervención (Ensayos clínicos) para la búsqueda y revisión bibliográfica de evidencia científica respecto a la alimentación restringida en el tiempo y su impacto sobre la obesidad. Pubmed fue la principal base de datos que se utilizó, de la cual se analizaron detalladamente un total de 13 ensayos clínicos. La alimentación restringida en el tiempo, es una buena estrategia alternativa para el tratamiento de la obesidad.

Introduction

According to the International Classification of Diseases (ICD-11) of the World Health Organization (WHO) (1), obesity is defined as: "a complex chronic disease defined by excessive adiposity that can impair health." In addition, this pathology is a risk factor for diseases such as diabetes mellitus, arterial hypertension, insulin resistance, dyslipidemia and cardiovascular diseases (2-6).

This is a growing health problem and constitutes a global epidemic. According to WHO (7), in 1990, 25% of adults were overweight and by 2022 the prevalence increased to 44% in adults over 18 years of age.

In Spain, according to data from the 2020 European Health Survey (8), the prevalence of obesity in men and women over 18 years of age was 16.5% and 15.5%, considering these growing figures and the potential damage to health that obesity entails, it is necessary to generate prevention and treatment strategies that are safe and sustainable over time (8).

Regarding the dietary-nutritional approach for the treatment of obesity, it is possible to point out that the main objective is to reduce body weight between 5% and 20% depending on the BMI and the primary strategy used to achieve this is caloric restriction (9). It has been suggested that one of the most determining factors for the success of these interventions is the patient's adherence to the nutritional plan; therefore, for the patient with obesity, a very restrictive dietary regimen may not be a sustainable strategy in the long term (10,11).

Time-restricted feeding (ART) is an emerging strategy that aims to maintain a daily feeding and fasting cycle consistent with circadian cycles in order to promote them (12) and has been the focus of numerous studies and discussion, as it has been shown to have benefits in terms of body weight reduction and cardio metabolic benefits (13), but the evidence so far has yielded mixed results.

Researching and analyzing the evidence that exists to date on this subject, in order to determine the effectiveness of time-restricted feeding in the treatment of obesity, can be of great help in establishing alternative nutritional strategies for patients for whom caloric restriction or nutrient restriction alone may lead to failure in their nutritional treatments for obesity, as well as a long-term strategy to sustain the weight loss achieved with caloric restriction *(14,15).*

The main objective of this study was to assess the efficacy of ART as an alternative nutritional dietary treatment for obesity. The specific objectives are to determine the impact of time-restricted feeding on obesity and to determine whether there are differences between starting the feeding window in the morning or late in the day.

***Dietetic-nutritional strategies in the treatment of obesity*.**

The main objective in the treatment of obesity is the reduction of body weight by 5% to 10% over a period of 6 months (although depending on the degree of obesity it can be as much as 20%), together with changes in the patient's lifestyle habits (9).

Currently, most of the evidence-based dietary-nutritional interventions for reducing body weight and improving metabolic health can be classified into 3 main approaches (16):

- Calorie restriction: there is a reduction in energy intake, but the timing and frequency of meals are not manipulated.
- Intermittent fasting: 1 or more fasting days are alternated with ad libitum feeding days.

- Time-restricted feeding or time-restricted feeding (ART): in a 24-hour period a fasting window (12 to 16 hrs) and a feeding window is established depending on the hours established in the fasting window.

Time-Restricted Feeding.

It is called time-restricted feeding that protocol that restricts the time in which food is consumed in a period of 24hrs, usually in 4-12h feeding windows and fasting periods of 12 to 16h (17). Some authors argue that this is a chrono-nutritional strategy, since the period of food consumption and fasting is synchronized with the cycles of circadian rhythms, and that the possible benefits are due to this interaction (17,18).

The flexibility of ART protocols allows people to maintain their individual eating pattern preferences, which can facilitate adherence (17).

Missing target

Method (14 points)

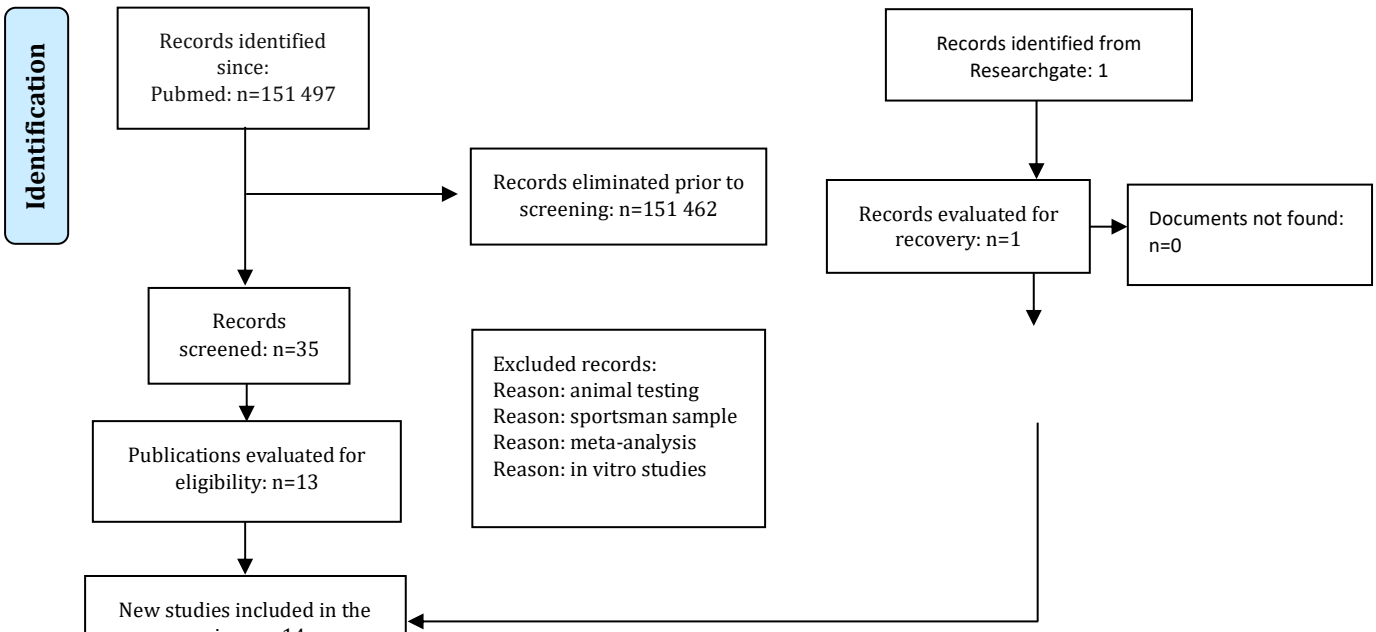
To conduct this research, which consisted of a literature search, key terms such as: time restricted feeding, overweight, body fat reduction, calorie restriction, early time restricted feeding, late time restricted feeding, circadian rhythm, etc. were determined and Boolean terms (AND AND AND OR) were used to further focus the results. Pubmed was used as the database, as can be seen in the article selection diagram (Figure 1).

On the other hand, the following search criteria were established: Articles not older than 5 years and only clinical trials.

For the selection of articles, the following exclusion criteria were established:

- Interventions in the sports or exercise population.
- Interventions in which programmed exercise was involved as part of the intervention.
- Meta-analysis.
- Animal or in vitro tests.
- Interventions that did not assess weight loss or body composition.
- Items that were not complete.

For the selection of papers, we considered interventions in which participants were overweight or obese, regardless of whether they also suffered from other diseases such as kidney disease, cancer or metabolic syndrome, as long as they evaluated weight loss and change in body composition.



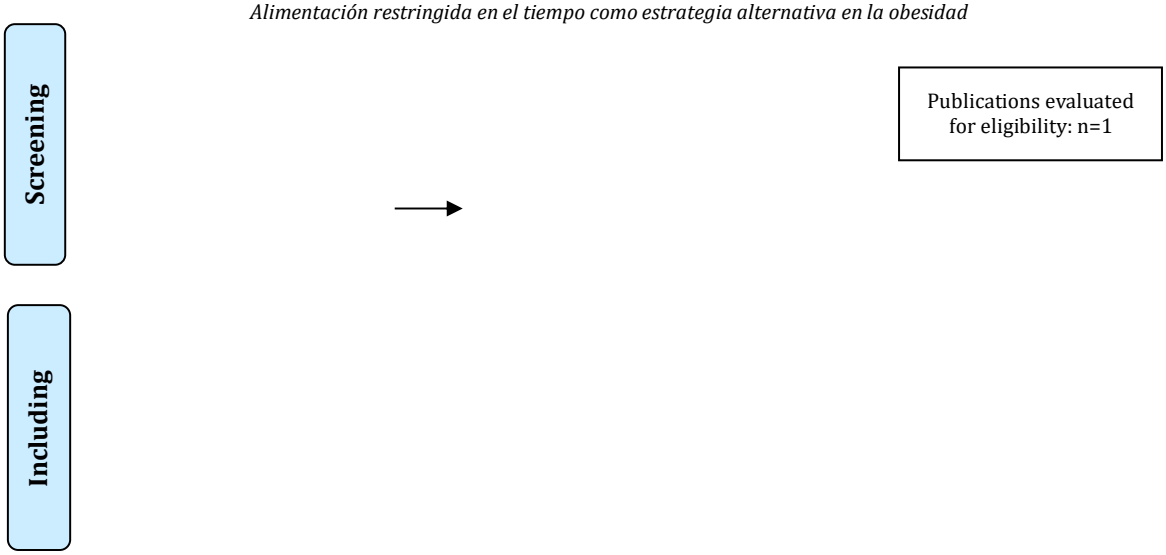


Figure 1. Study selection flowchart.

After the articles were selected, they were stored and reviewed in detail to prepare the main part of the work. Of the total number of articles reviewed, 13 were analyzed in depth. In the case of the data from the selected interventions, only those data and outcomes that were related to weight loss and body composition were used.
Of the 13 articles that were reviewed in depth, 8 of them were used for the section on ART and its impact on obesity and the rest for the section on the differences of ART protocols in their effect on obesity.

Results and Discussion (14 points)

In a recent randomized controlled trial, Lin S. et al. (19) analyzed the effectiveness of Time-Restricted Eating (ART) for weight loss and improvement of cardio-metabolic risk compared to traditional calorie restriction (CR). For 12 months, 90 participants were divided into three groups: one practicing ART with an 8-hour feeding window (12 to 8 p.m.), one with a 25% calorie reduction, and a control group that had a wider feeding window of 10 hours or more. The results showed a significant weight reduction in both the ART and CR groups, with no notable differences between the two in terms of weight loss. However, both approaches were more effective than the control group.

In previous studies, Wilkinson M. et al. (20) observed improvements in body composition and weight reduction with ART within 12 weeks. For their part, Steger F. et al. (21) highlighted benefits not only in cardio-metabolic markers, but also in mood when an early ART protocol was followed. However, other studies have shown mixed results. Lowe et al. (22) found that ART was less effective compared to more structured diets. Meanwhile, De Oliveira et al. (23) and Schroeder J. et al. (24) observed moderate improvements in body composition with ART, although without significant changes in blood markers.

Recent studies on Time-Restricted Feeding (ART) highlight important differences between early (ARTt) and late (ARTm) feeding protocols, with several investigations showing greater metabolic benefits associated with ARTt. Xie Z et al. (28) found that ARTt significantly improved insulin sensitivity, reduced fasting glucose, and promoted weight loss compared with ARTm and the control group, whereas Madjd A et al. (29) observed

greater weight loss in those who consumed an early versus a late dinner, highlighting the impact of meal timing on metabolic outcomes. Hatanaka et al. (30) also noted greater weight loss in those who started their feeding window earlier. Taken together, these studies suggest that meal timing, especially when performed early, offers advantages for weight loss and improvement of cardio-metabolic markers (28-34). All detailed information is presented in the tables below

Regarding time-restricted feeding and its impact on weight loss, this work compiles 8 interventions (19-27), with a total of 463 people. The results of these investigations provide evidence confirming that ART is an equally efficient strategy as caloric restriction for weight loss when performed in a caloric deficit protocol; however, (19) applied an ART protocol in which participants were allowed to eat ad libitum during the feeding window. At the end of this study, the ART group had a weight decrease and improvement in body composition similar to that of the control group, but the results obtained could be due to the fact that, like the control group, the participants involuntarily reduced their energy intake by -425kcal/day, which would explain that the weight loss in this group was due to an involuntary caloric deficit rather than an effect of ART per se.

In contrast, 1 (25) of the 7 interventions found no major differences in body weight reduction with respect to the control group, Lowe D et al (25) concluded that the ART diet does not generate a greater benefit for body weight loss or changes in body composition, nor improvements in metabolic markers, compared to eating 3 meals a day, in this study it was seen that 65% of the weight lost was lean mass, so it may not be a good nutritional approach for patients with decreased lean mass. However, one of its major limitations is that there was no record of the quality of the food ingested, the distribution of nutrients (carbohydrates, proteins and lipids), nor the total energy intake, so the results could be influenced by these factors and not by an effect of the ART as such. 5 interventions used 8-hour feeding windows (19,21,24,25,27). In all of them, a statistically significant weight loss was observed in the ART group versus the control group, although it is difficult to determine that ART was the determining factor, since some of these interventions added caloric restriction to the protocol (21) and others did not (19-25), while in 2 of these interventions the protocol was adjusted to the nutrient needs of the study group (26,27), in summary, when the intervention protocol compared an ART protocol (with or without caloric restriction) versus a group which was subjected to a caloric deficit with no time restriction in the feeding window, the results had no significant differences, but the results were not significantly different, the results had no significant differences, but when comparing ART with a control group that did not maintain caloric deficit, the weight loss and change in body composition is significant, this could be explained by the involuntary reduction of energy intake during an 8h ART protocol observed by Lin S (19) in his study and that could explain the results that Wilkinson M et al, in 2020 (20), obtained with their study, which in addition to finding positive results in body weight reduction of 275g/week, also saw a decrease in the fat percentage of the ART protocol participants.

de Oliveira et al 2020 (23), in their intervention, -unlike the other interventions seen in this work-, after 12 weeks of intervention, did not find significant changes in the body weight of the participants of their intervention, however, they observed that there was a slight decrease in hip circumference and body fat, which leads them to suggest that this strategy could help in the management of obesity in the long term. They support them, explaining that the fasting state could generate a metabolic flexibility, mediating

processes in favor of fatty acid oxidation, which could explain the decrease in the final values of hip circumference and body fat.

Regarding the differences between starting the feeding window early and late, according to the studies compiled in this work, there is more evidence suggesting that starting the feeding window early has more benefits in terms of weight loss compared to feeding protocols whose feeding window starts late. However, there are few studies that directly compare those effects within the context of a late and early ART protocol (24), the other studies did not use protocols that shortened feeding windows, so it is difficult to extrapolate the results to an ART protocol context, however, the results of the studies presented here point in favor of starting the feeding window early. These results may be due to the interaction of metabolism and metabolic pathways with clock genes and circadian cycles, which in turn regulate hormonal pulses such as insulin, cortisol, melatonin, ghrelin, leptin, etc.. .

The objective of this literature review was to determine the efficacy of time-restricted feeding as an alternative nutritional dietary treatment for obesity and to determine whether there are differences in the effects on obesity between starting the feeding window early or late.

Table 1. Selected studies on time-restricted feeding and its effect on obesity.

Author, Year	***Type of study***	***Subjects/Groups Protocol and duration of intervention***	***Results***	***Conclusions***
Lin S et al, 2023 (19)	Randomized clinical trial.	n=90 people with obesity. GC: Power window ≥10h without restriction. ART: ART Protocol 8:16 (12am to 8pm) without caloric restriction. GRC: 25% caloric restriction Duration: 12 weeks	Significant decrease in body weight in the ART group compared to the control group, but not significant compared to the caloric restriction group. Weight loss control group: 0.81 kg [CI, -3.07 to 4.69 kg; P = 0.68]). ART: Average reduction of -425 kcal/day, weight loss: -5.42 kg (95% CI, -7.37 to -1.85 kg; P ≤ 0.01). GRC: Average reduction of -405 kcal/day, Weight loss**:**-5.42 kg (CI, -9.13 to -1.71 kg; P ≤ 0.01).	With respect to weight loss, ART is more effective compared to the control group, but is not more effective than caloric restriction
Wilkinson M et al, 2020 (20)	Single-group quasi-experimental pre-post study.	n= 25 adults ≥18 years GE: ART protocol 10:14 (10h feeding window) Duration: 12 weeks.	Decrease in body weight, fat % and waist circumference. Weight loss: -3.30±3.20 kg (-3%), p=0.00028 (average loss 275g/week) BMI: -1.09±0.97 kg/m2 (-3%), p=0.00011 Body fat: -1.01±0.91%(-3%), p=0.00013 Visceral fat index:-0.58±0.77 (-3%), p=0.004 Waist circumference: -4.46±6.72 cm (-4%), p=0.0097.	A 10-h ART intervention for 12 weeks, without an overt attempt to change physical activity or diet quality or quantity, may serve as a novel treatment for individuals with metabolic syndrome. The decrease in waist circumference correlated with weight change (p=0.017), with a decrease in the interval between meals (p=0.005) and a combined change in weight and interval between meals (p=0.004).
Steger F et al, 2022, 2023 (21-22)	Randomized clinical trial.	n=90 adults with obesity. GC: ≥12h feeding window + caloric restriction. ART: 8:16 time-restricted early feeding protocol (with feeding window from 7:00 until 15:00h) + caloric restriction. Duration: 14 weeks.	GC: Weight loss: −4.0 kg [-4.2%]; 95% CI, -5.1 to -2.9 kg; P < .001 ART: Weight loss: −6.3 kg [-5.7%]; 95% CI, -7.4 to -5.2 kg; P <0 .001. With respect to fat loss, in none of the groups was it significant.	ART is a valuable approach to improving weight, body fat, cardio metabolic health and mood.
De Oliveira Maranhão Maranhão Pureza IR et al, 2020 (23)	Randomized controlled clinical trial	n=58 women with obesity. GC: ART hypocaloric diet: 12:12 time-restricted feeding protocol + caloric restriction. Duration: 12 weeks	No major changes in body weight were found: −1.64%, 95% CI [-3.08; -0.19]%, p=0.02 Slight decrease in body fat and waist circumference.	The fasting state could generate metabolic flexibility, mediating processes in favor of fatty acid oxidation.
Schroeder J et al, 2021 (24)	Non-randomized controlled clinical trial	n=32 women with obesity. GC: Unmodified diet and lifestyle habits. ART: time-restricted feeding protocol 8:16 (feeding window from 12 pm to 8 pm) without caloric restriction. Duration: 12 weeks	Significant reduction in body weight, fat %, fat mass and waist circumference. In body weight and fat mass for the ART group, respectively were: (Start of rehearsal: (83.62kg ± 3.95) 3rd month: (80.24 ± 3.87)) and (Trial start: (36.91kg ± 2.30) 3rd month: (34.74 ± 2.24)) Control group: (Start of rehearsal: (87.14 ± 3.25) 3rd month: (88.49 ± 3.04)) and (Trial start: (39.74 ± 2.00) 3rd month: (40.59 ± 1.95)	ART is an effective dietary strategy to promote weight loss and decrease WC without notable changes in blood biomarkers.

Lowe et al, 2020 (25)	Randomized clinical trial	n= 116 overweight or obese adults. GC: 3 structured meals per day ART: 8:16 time restricted feeding protocol (feeding window from 12pm to 8pm). Duration: 12 weeks	Average weight loss of 1.70 kg in the ART group, however, 65% corresponded to lean mass, i.e., 1.10 kg of this weight loss was lean mass and only an average of 0.51 kg of fat mass.	(1) do not support the efficacy of ART for weight loss, (2) emphasize the importance of control interventions, and (3) offer caution about the possible effects of ERT on GLM. Future studies should be directed at understanding the effects of early versus late ART and protein intake or timing of intake as a means of compensating for loss of GLM.
Lao B et al, 2023 (26)	Non-randomized controlled clinical trial	n= 28 renal patients with overweight or obesity. GC: which was prescribed a high quality low protein diet, with no hourly restriction to eat ART: 8:16 (with the 8h feeding window starting at 7am) contemplating 3 meal times within that window. Duration: 12 weeks	GC: Weight loss: -0.4 ± 1.4 kg, Body fat: = -0.4 ± 1.8 kg, Visceral fat: -0.2 ± 0.8 ART: Weight loss: -2.8 ± 2.9 kg Body fat: -1.8 ± 2.4kg Visceral fat: -0.7 ± 0.9 Decrease in body weight, body fat mass, visceral fat.	ART can help improve renal function in moderate to severe CKD patients who are overweight and obese. This may be due to patients' weight loss, stable nutritional status and an increase in beneficial bacteria in the intestinal microbiota.
Vega C et al, 2024 (27)	Non-randomized open clinical trial	n= 21 patients with overweight or obesity and breast cancer. GC: Caloric restriction of 25% of total energy expenditure, distributed in 4 meals and 1 snack. ART: ART 8:16 protocol (8h feeding window). Duration: 12 weeks.	GC: Weight reduction: -3.02 kg Waist circumference: −4.14cm ART: Weight reduction: −6.84 kg Waist circumference: −7.5cm Weight loss and reduction of waist circumference in ART was greater than in the CG.	Both interventions are effective and statistically significant for weight loss and waist circumference reduction, with RFA showing potentially greater impact and better adherence. Changes in LDL, HDL, total cholesterol, triglycerides, glucose and insulin were not statistically significant.

GC: Control Group; ART: Time-restricted feeding; GRC: Caloric restriction group.

Table 2. Selected studies on the differences in the impact on obesity between starting early and starting late.

Author, Year	***Type of study***	***Subjects/Groups Protocol and duration of intervention***	***Results***	***Conclusions***
Xie Z et al, 2022 (28)	Randomized controlled trial.	n= 90 adults .GC: No restriction on meal times. ARTt: ART 8:16 protocol (between 6:00 am and 3:00 pm) without caloric restriction. ARTm: ART 8:16 protocol (between 11:00 am and 8:00 pm) without caloric restriction. Duration: 5 weeks.	Reduced energy intake: GC: (Δ = 64 ± 286 kcal/day) ARTt: (Δ = -240 ± 409 kcal/day) ARTt vs GR: p=0.001 (significant decrease) ARTm: (Δ = -159 ± 397 kcal/day) ARTm vs GR: p=0.01 (significant decrease) ARTm vs ARTt (no significant difference.) Weight (kg) and % fat: GC: (Δ = 0.3 ± 1.2 kg) (Δ = 0.42 ± 1.16%) ARTt: (Δ = -1.6 ± 1.4 kg) (Δ = -0.60 ± 1.22%) ARTt vs GR: p=0.042 and p=0.001 (significant decrease) ARTm: (Δ = -0.2 ± 2.2 kg) (Δ = -0.22 ± 1.70%) ARTm vs ARTt (no significant difference).	When comparing the 3 protocols, ARTt is more beneficial for body weight reduction and metabolic health.
Madjd A et al, 2021 (29)	Randomized clinical trial.	n= 82 women, Groups: EEM: Dinner between 19:00 and 19:30h + hypocaloric diet (500-1000kcal deficit and distribution of the caloric molecule: 17% Proteins / 23% lipids / 60% carbohydrates). LEM: Dinner between 10:00 p.m. and 10:00 p.m: 30 and 23:00h + hypocaloric diet (deficit of 500-1000kcal distribution of the caloric molecule: 17% Proteins / 23% lipids / 60% carbohydrates). Duration: 12 weeks.	EEM Group: Weight lost: −6.74 (SD 1.92)kg, BMI: −2.60 (SD 0.71) kg/m2, Waist circumference: −8 (SD 3.25) cm LEM Group: Weight lost: −4.81 (SD 2.22) kg, BMI: −1.87 (SD 0.85) kg/m2, Waist circumference: −6 (SD 3.05) cm, EEM vs LEM (p-value) : Weight lost: P< 0.001 BMI: P < 0.001, Waist circumference: P = 0.007The EEM group showed significant differences in weight, BMI and waist circumference reduction with respect to the LEM group.	In the short term, early dinner intake is more beneficial than late intake for weight loss, insulin sensitivity and lipid profile. Therefore, in overweight or obese individuals, dietary recommendations designed to achieve weight reduction should include advice on the timing of dinner intake, in addition to giving recommendations on overall energy intake.
Hatanaka et al, 2021 (30)	Second analysis of a randomized controlled clinical trial	n= 97 Adults G1: They started the feeding window at 6:48am. (25 men and 22 women) G2: They started the feeding window at 8:09am. (26 men and 24 women). Duration: 12 weeks	The weight loss of group 1 was -3.8 ± 2.7% vs. -2.2 ± 2.5% in group 2.	There was a greater effect on weight loss in those who started feeding earlier (however, they acknowledge many limitations).
Gu et al, 2020 (32)	Randomized controlled clinical trial	n= 20 Healthy people (10 men 10 women) LD: Late dinner 22:00h RD: Early dinner 18:00h Both groups received a dinner with an isocaloric distribution of nutrients (35% of daily kcal, 50% CHO, 35% lipids) Duration: 14 days, including 2 visits of 3 days and 2 nights to the research center.	LD caused a 4-hour shift in the postprandial period, overlapping with the sleep phase. Independent of this change, the postprandial period after LD was characterized by an increase in glucose, a delay in the triglyceride peak, and a reduction in the rate of oxidation of dietary fatty acids. LD did not affect sleep structure, however, it increased plasma cortisol.	Late dinner consumption induces the oxidation and mobilization of fatty acids, effects that could favor obesity.
Queiroz et al 2022 (33)	Randomized, parallel group, single-center trial.	n= 13 adults with overweight and obesity. CG (CR): Caloric deficit of 25% of their energy needs and feeding schedule from 8:00 a.m. to 8:00 p.m. eTRE: Early feeding protocol restricted in time 8:16 (with feeding window from 8:00 to 16:00h) + 25% caloric deficit with respect to their	GC: Weight lost: (−4.0kg; 95 % CI, -5.9, -2.1) Fat Mass: (−3.1 kg; 95 % CI, -4.3, -1.8) eTRE: Weight lost: (−4.2kg; 95 % CI, -5.6, -2.7) Fat Mass: (−2.9kg; 95 % CI, -3.9, -1.9) dTRE: Weight lost: (−4.8kg; 95 % CI, -5.9, -3.7) Fat Mass (-3.6kg; 95 % CI, −4.6, −2.5).	Under caloric restriction conditions, the three protocols (dTRE + CR, eTRE and CR) have similar effects on improving body composition and decreasing body weight.

		energy needs. dTRE: Late feeding protocol restricted in time 8:16 (with feeding window from 12:00 to 20:00h) + caloric deficit of 25% with respect to their energy needs. Duration: 8 weeks-		
Allison et al. 2021 (34)	Randomized crossover study	n= 12 Adults Protocol 1: Early feeding window (8:00 a.m. to 7:00 p.m.). Protocol 2: Power window late (12:00 to 23:00h). Washout period between protocols: 2 weeks Duration: 8 weeks	Results protocol 1 (Mean): PRE: Weight (kg): 65.4, Total fat (%): 27.6 Lean mass(%):14.5 POST: Weight (kg): 64.3, Total fat (%): 27.9, Lean mass(%):14.7 Results protocol 2 (Mean): PRE: Weight (kg): 64.8, Total fat (%): 28.0, Lean mass(%): 14.7 POST: Weight, (kg): 64.5, Total fat (%): 27.6, Lean mass(%): 15.	Eating earlier improves weight and several key metabolic outcomes in healthy individuals.

ARTt: time-restricted early feeding; ARTm: time-restricted midday feeding; GC: Control group; EEM: Early evening dinner; LEM: late evening dinner; LD: *Late dinner: late dinner; RD: Regular dinner: Early dinner; dRTE:* Late time-restricted feeding; eRTE: Early restricted feeding.

Conclusions

Considering the above, it is possible to conclude that early ART could be a good alternative strategy for the treatment of obesity, since it is as effective as caloric restriction. However, for the future, more studies are needed, with larger samples, to determine the mechanisms by which ART works and to confirm that the results are not mediated by caloric deficit.

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