

REVIEW ARTICLE

Overcoming Weight Loss Plateaus: Evidence-Based Nutritional and Behavioral Strategies—A Narrative Review

Ruba Musharbash*^{1,3}, Nour Elshahory², Marry Rose Awies², Areen Haddad¹

¹Department of Nutrition and Food Technology, Human Nutrition and Dietetics, The University of Jordan, Amman, Jordan.

²Department of Nutrition, Faculty of Pharmacy and Medical Sciences, University of Petra, Amman, Jordan.

³Ruba Musharbash center for nutrition counseling, Amman, Jordan.

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ABSTRACT

A weight plateau is a common and clinically challenging occurrence in weight management, marked by stable body weight despite adherence to physical exercise and a diet low in calories. This phenomenon can hinder progress and motivation. While several theories exist regarding its cause, effective clinical interventions remain limited. This review explores evidence-based strategies to overcome weight plateaus in clinical practice, examines physiological and behavioral contributors, and synthesizes current approaches into a practical framework to guide healthcare providers in supporting patients through plateau phases. A narrative review was conducted using peer-reviewed literature sourced from PubMed, Google Scholar, Scopus, and Web of Science. The search included studies published between 2007 and 2024, using keywords such as “weight plateau,” “dietary intervention,” “physical activity,” “energy restriction,” and “clinical strategies.” Human studies, clinical trials, and systematic reviews were prioritized. Weight plateaus are multifactorial, involving metabolic adaptation, hormonal shifts, and behavioral fatigue. Effective strategies include adjusting macronutrient distribution, intermittent energy restriction, circadian-aligned meal timing, and combining aerobic and resistance training. Additional interventions include enhancing non-exercise activity thermogenesis (NEAT) and identifying underlying health issues. High-protein, ketogenic, and very low-calorie diets (VLCDs) might be applied selectively under supervision. While evidence supports individualized strategies, consensus on standardized protocols is lacking. This review supports individualized, multifaceted interventions and emphasizes the need for further research to establish evidence-based clinical guidelines.

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*Corresponding author

E-mail: rubarsearch20@gmail.com (Ruba Musharbash, Ph.D., MS)

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1. INTRODUCTION

Maintaining weight loss over the long term is still very difficult, often marked by high failure rates despite lifestyle changes (Montesi et al., 2016). A weight plateau (WP) is the inability to lose more weight despite ongoing adherence to an energy-restricted diet, often due to metabolic adaptation (MA)—the body's natural mechanism to conserve energy (Martínez-Gómez & Roberts, 2022). This response hinders long-term weight loss success. WPs vary in timing, with some occurring after more than a year of intervention (MacLean et al., 2011). Although weight loss methods are widely used, there is still no evidence of long-term success. According to a meta-analysis of 29 long-term weight loss trials (Hall & Kahan, 2018), over half of the weight lost was recovered within two years, and by five years, over 80% of the weight lost was restored.

Several factors contribute to WPs and potential weight regain, including hormonal imbalances that raise appetite and reduce energy expenditure (MacLean et al., 2011), as well as muscle mass loss, which lowers metabolic rate (KAIKKONEN et al., 2019). Psychological stress can promote emotional eating, disrupt hormones, decrease leptin, and raise ghrelin levels, all of which hinder weight loss (Ochner et al., 2013). Reduced physical activity also contributes to lower energy expenditure as the body adapts (KAIKKONEN et al., 2019). Aging worsens MA by increasing visceral fat, reducing metabolic rate, and shifting body composition through muscle loss and fat redistribution (Palmer and Jensen, 2022). These factors highlight the need for a comprehensive strategy to maintain long-term weight loss.

Before starting dietary interventions, dietitians must address key factors by offering nutritional education and individualized plans (Lee 2023; Makin et al., 2021), ensuring a balanced macronutrient intake (Kheniser et al., 2021), adequate sleep aligned with circadian rhythms (Queiroz et al., 2020), and correcting any vitamin or mineral deficiencies. It's also important to assess and manage underlying medical conditions, promote non-exercise activity thermogenesis (NEAT) (Chaput et al. 2011; Peos et al., 2019), and for optimal outcomes, combine resistance and aerobic exercise together. (Bellicha et al., 2021). If WP occurs, individualized therapeutic diets suited to the person's health status may help overcome it and promote further weight loss. This review explores current evidence on dietary and behavioral strategies for addressing WPs with a personalized approach.

2. METHODOLOGY

This narrative review examines therapeutic strategies to address weight plateaus (WP) during the weight loss journey by synthesizing peer-reviewed literature. A comprehensive investigation was carried out in PubMed, Scopus, Web of Science, and Google Scholar using keywords such as “weight plateau,” “weight loss interventions,” “VLCD,” “diet break,” “ketogenic diet,” “intermittent fasting,” “exercise and weight

management,” “behavioral interventions,” and “obesity management.” Only peer-reviewed human studies, clinical trials, and systematic reviews were included; grey literature and non-peer-reviewed sources were excluded to ensure scientific rigor.

English-language studies published between 2007 and 2024 were included. Only studies published in English were included due to resource and translation constraints, which may introduce a risk of language bias. Eligible studies consisted of original research, systematic reviews, and meta-analyses on dietary, behavioral, or exercise-based interventions. Excluded were non-peer-reviewed papers, editorials, commentaries, studies lacking methodological relevance, and those focusing solely on pharmacological treatments.

The narrative review method was selected to critically evaluate current evidence, identify research gaps, and offer practical recommendations for managing WPs. However, a narrative review was chosen to synthesize a wide range of heterogeneous interventions and behavioral strategies for managing weight plateaus, which varied significantly in methodology, population, and outcome measures, making them unsuitable for meta-analysis.

3. RESULTS AND DISCUSSION

After screening, 200 publications were identified, with 35 studies meeting the inclusion criteria (20 original research articles and 15 reviews), as shown in **Figure 1**. Data were extracted on study design, population, interventions, and outcomes. Key themes analyzed included VLCDs, ketogenic diets, behavioral strategies, and exercise interventions.

Various approaches have been explored to break through weight plateaus, each with distinct mechanisms and efficacy. Motivational interviewing and tailored dietary strategies have shown promise in improving long-term adherence. Meal timing modifications, such as time-restricted eating, may influence metabolism and support progress. Exercise—particularly resistance training—can enhance metabolic rate and preserve muscle mass. Therapeutic diets like ketogenic and high-protein plans have been studied for their role in maintaining lean mass and promoting fat loss. In cases of strong resistance to weight loss, surgical and pharmacological options may be considered. The diversity in strategies underscores the need for individualized approaches based on each person's metabolic profile, health condition, and preferences.

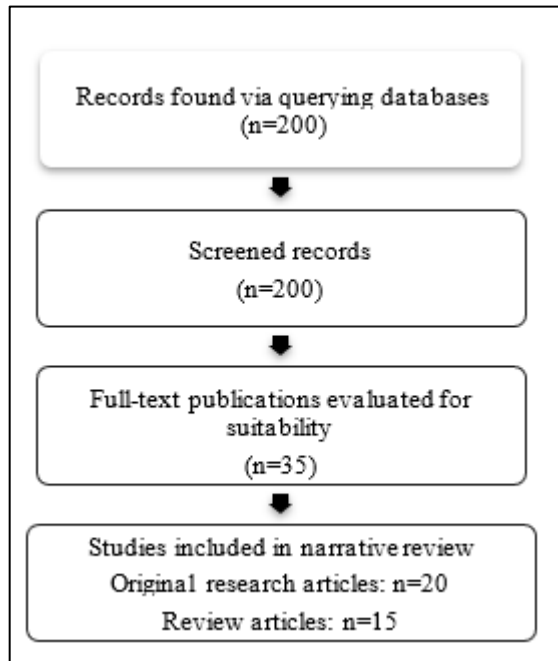


Fig. 1. An illustration of the study selection procedure's flow

Table 1 provides an overview of the original research that has been conducted on how dietary changes affect weight reduction and weight plateaus. Primary dietary changes, such as adjustments to energy restriction and the distribution of macronutrients, are among these interventions. Dietary interventions in conjunction with motivational interviewing are also included to improve adherence. Exercise regimens, meal timing modifications, and therapeutic dietary strategies—like ketogenic and high-protein diets—have also been researched. Pharmacological treatments and surgical procedures are also thought to be viable options for breaking through weight loss plateaus in more difficult cases.

3.1 Primary Dietary Intervention

3.1.1 Dietary intervention with motivational interviewing

Recently, motivational interviewing (MI) has become a popular counseling approach for managing illnesses and promoting health. This paradigm emphasizes the adoption of a person-centered, nonconfrontational approach to help clients overcome ambivalence, lessen resistance, and encourage educators and other medical professionals who work in nutrition education to start lifestyle counseling (VanWormer & Boucher, 2004).

The application of a systematic method is critical for accurately identifying and intervening in individuals encountering WP along their weight loss journey. The initial step involves examining any underlying health conditions that may hinder weight loss management, including diabetes, insulin resistance, hypothyroidism, or any deficiencies in essential vitamins and minerals. These factors may significantly impact metabolic

efficiency and the management of body weight (Barnes and Ivejaz, 2015).

Employing motivational interviewing in weight loss management is essential to assessing the individual's existing dietary practices and eating behaviors. Essential factors include whether the diet plan is being followed under the supervision of a qualified dietitian, the duration of WP after initial weight reduction, and prior strategies used to address the plateau (Speakman and Hall, 2023). Additionally, meal time must be assessed within the intervention process, as aligning meal patterns with the body's circadian rhythm or adopting intermittent fasting regimes may optimize metabolic functions and further facilitate fat and weight loss (Kim, 2021). Additional important approaches in meal timing, including the reduction of late-night eating patterns or consolidating meals into certain eating periods, may also contribute to further improving metabolic results (Kim, 2021).

A personalized dietary plan must be developed according to the individual's needs and objectives after a preliminary assessment phase conducted by the clinical dietitian. Ongoing monitoring of results is critical to evaluate the dietary plan's efficiency and implement any necessary adjustments (Kim, 2021). The intervention plan must include and promote physical activity. Structured exercises like aerobic and resistance training, as well as NEAT, should be emphasized. The Neat Compromise activities, such as Walking, standing, and daily movement, are also beneficial for increasing overall energy expenditure (Phelan et al., 2020).

If weight gain persists after following a balanced, low-calorie diet and consistent exercise, different therapeutic diets may be considered; if weight gain persists, then drug treatments or surgical options like bariatric surgery may be considered. Such procedures should only be considered when clinically indicated and after all non-invasive methods have been thoroughly implemented and evaluated (Hall, 2024). This approach ensures that individuals experiencing WP receive tailored, evidence-based solutions to address their weight reduction challenges. By incorporating motivational interviewing techniques, implementing precise dietary modifications, and designing appropriate physical activity programs, practitioners can significantly improve the chance of achieving successful results.

3.1.2 Meal timing

This process has a big effect on weight management, so the intervention should push people to eat meals that are in sync with their circadian rhythm, with the main focus being on eating most of their meals during the day (MacHill et al., 2024). This technique supports metabolic health by improving digestion, nutrient absorption, and thermogenesis. Furthermore, time-restricted feeding has been shown to mitigate obesity and enhance metabolic and weight management outcomes (Kim, 2021).

For further enhanced results, especially if a weight plateau arises despite adherence to a low-calorie diet and activity, intermittent fasting, including the 5:2 approach, may serve as a successful treatment for a limited duration (Queiroz et al., 2020).

3.1.3 Exercise

Is an essential component of managing weight loss and is particularly helpful for individuals when combined with a suitable low-calorie diet plan (Wu et al., 2024). Compared to controls, structured exercise regimens result in a slight but statistically significant weight loss of 1.5–3.5 kg (Bellicha et al., 2021; Johns et al., 2014). Aerobic exercise is recognized as extremely beneficial, attaining a 1.6–1.7 kg weight loss on average over 6–12 months. Similarly, high-intensity interval training (HIT) demonstrates comparable efficacy, with a mean weight reduction of 1.5 kg, particularly when energy expenditure aligns with moderate-intensity continuous training (MICT) (Bellicha et al., 2021).

Resistance exercise, however less beneficial for comprehensive weight loss management, is essential for maintaining lean mass when following a diet low in calories (Janssen et al., 2023). Importantly, A low-calorie diet combined with exercise produces better benefits than a diet plan alone. (Martínez-Gómez & Roberts, 2022); this enhances fat loss and reduces visceral fat, which is vital for cardiometabolic health. Individuals aiming to overcome WPs should integrate both aerobic and resistance training, or HIT, as part of their strategy for weight management (de Assis and Murawska-Ciałowicz, 2023). If WP persists despite a low-calorie diet and exercise commitment, other therapeutic diets may be incorporated.

3.2 Therapeutic dietary approaches

Therapeutic diets aimed at overcoming weight plateaus are designed to address physiological and metabolic adaptations that can hinder further weight loss (Morsali et al., 2021). These interventions share principles with medical nutrition therapy (MNT) used in managing conditions like diabetes but are specifically tailored to counteract adaptive thermogenesis and other metabolic changes that contribute to weight loss resistance (Rosenbaum & Leibel, 2010). These diets are not suitable for all individuals and must be implemented under the supervision of healthcare providers, as improper application may result in negative health outcomes (Singar et al., 2024). Additionally, strict adherence to these diets is necessary, with ongoing monitoring to ensure they are followed appropriately according to the patient's unique health requirements (Groppe, 2023).

The use of therapeutic diets to address weight loss plateaus has been the subject of numerous studies. While some research attributes early weight-loss plateaus to inconsistent dietary adherence (Thomas et al., 2014). However, other findings point to a more intrinsic physiological limit after extended dieting periods (Landry et al., 2024). This contrast underscores the importance of individualized evaluation before modifying

dietary strategies. Furthermore, Weight-loss plateaus for various strategies involving reduced-energy diets and/or weight-management medications occur approximately six months, according to a review, suggesting a typical period for this phenomenon. (Cunningham, 2011). These results highlight how difficult it is to control weight and how persistent, customized approaches are required to break through plateaus.

3.2.1 High protein diet

High protein diets may be beneficial when WP happens, offering many advantages that support weight reduction and metabolic health. Thermodynamic effects of protein are higher on food than carbohydrates and fat, elevating energy expenditure (Calcagno et al., 2019). Additionally, high diets enhance satiety, thereby decreasing daily calorie intake and aiding in the preservation of muscle mass when under low-calorie diets (Moon and Koh, 2021). The recommended protein intake when following a high-protein diet for overweight and obese individuals is 1.2–1.6 g/kg of ideal body weight (Campbell et al., 2007), as this range has been shown to enhance fat loss while preserving lean mass, improving satiety, and increasing thermogenesis during energy restriction (Jäger et al., 2017), whereas athletes may benefit from higher intakes of up to 2 g/kg of ideal body weight for weight loss and improved exercise performance (Campbell et al., 2007), due to their elevated demands for muscle maintenance, recovery, and performance enhancement during weight loss (Jäger et al., 2017).

Energy distribution typically comprises 20–35% of protein, and the remainder is derived from carbohydrates and fats (Aaseth et al., 2021). However, excessive consumption of fat and protein may raise the risk of type 2 diabetes, according to some research. Protein-induced acid loads, such as sulfuric acid generated from the oxidation of methionine and cysteine, are another reason why diets high in protein may be harmful to the kidneys. Although high-protein diets are linked to increases in blood urea levels and urinary calcium excretion, which may be linked to an increased risk of kidney stone development, they do not negatively affect kidney function in healthy persons (Kim, 2021). Yet, patients with obesity should have their long-term high-protein consumption, particularly from animal sources, properly monitored because obesity is linked to chronic kidney disease and a high prevalence of subclinical chronic kidney disease (Garofalo et al., 2017; Ko et al., 2020).

3.2.2 Ketogenic diet

A ketogenic diet is a popular approach for facilitating weight and fat reduction, particularly in a short time (Dowis & Banga, 2021). This dietary strategy induces fat loss by causing a state of ketosis. A standard ketogenic diet typically comprises 70–75% of daily calorie intake from fat, with a very low carbohydrate content of less than 50 grams per day (5–10%) and a moderate protein content of 20–25% to preserve lean muscle mass (Alharbi & Al-Sowayan, 2020; Dowis & Banga, 2021). By changing the body's

main energy source from carbohydrates to fats, this macronutrient distribution helps people lose weight rapidly (Jabbour et al., 2022). Nonetheless, prolonged adherence to the diet may result in adverse consequences, including vitamin and mineral deficiencies, dehydration, and many individuals experience symptoms related to electrolyte imbalances, hypoglycemia, and fluid shifts during the initial adaptation phase of a ketogenic diet (Alharbi and Al-Sowayan, 2020).

3.2.3 Intermittent calorie restriction (ICR)

Often referred to as “diet breaks - are a type of diet plan in which a set number of calories and macro/micronutrients are consumed every day for a continuous period of four or more days to several weeks in order to maintain weight (or slightly over)” or “diet refeed - a temporary overfeeding phase during which calorie intake is increased marginally over maintenance levels, primarily through increased ingestion of carbohydrates” (Escalante et al., 2020). These periods may vary from short durations of four days or more per week to extended intervals lasting several weeks (Escalante et al., 2020). In the Break study by (Cortez et al., 2023), the ICR group lost weight by cutting calories for two weeks and then increasing calories for one week to meet their needs without cutting calorie intake. This made a total of 23 weeks of active weight loss. The macronutrient composition for both the ICR and continuous energy restriction groups consisted of 35% protein, 35% carbohydrates, and 30% fat. Adhering to a Mediterranean diet emphasizes nutrient-dense foods.

Research conducted by Atkinson et al., (1993) investigated various durations of diet breaks. Longer diet intervals included seven weeks of energy restriction followed by six weeks of maintenance calorie intake, while shorter breaks comprised three weeks of energy restriction followed by two weeks of maintenance calorie intake, repeated three times. These have been shown to have physiological and psychological benefits, including replenishing glycogen reserves, enhancing fat loss, and alleviating the stress linked to extended calorie restriction. This method may be particularly beneficial for athletic individuals (Peos et al., 2021), and those with obesity, as it aids in the preservation of muscle mass and enhancement of metabolic health (Byrne et al., 2018). A typical diet break comprises 45-60% carbohydrates, 20-25 % protein, and 20-35% fat, with energy restriction maintained on non-refeed days to sustain health and muscle preservation (Cortez et al., 2023; Escalante et al., 2020).

Additionally, improved insulin sensitivity and glucose stabilization have been associated with ICR, which are metabolic benefits similar to those of continuous calorie restriction (Seimon et al., 2015). These structured diet breaks offer a sustainable and adaptable strategy for weight management, addressing WP, and

alleviating adaptive physiological responses, enhancing long-term compliance (Escalante et al., 2020).

3.2.4 Very low-calorie diets (VLCDs)

These are therapeutic diets that provide less than 800 kcal/day for the management of obesity and addressing WP, (Lee, 2023; Saris, 2001). These diets are categorized according to their macronutrient content and dietary structure (Table 2). The conventional VLCD comprises 30-50 g/day of carbohydrate (13-25%), 0.8-1.2 g/kg protein of ideal body weight (40-45%), and 15-30 g/day of fat (40-45%) of total energy (Muscogiuri et al., 2021). Protein-sparing modified fasts (PSMFs) emphasize high protein intake of 40-50% of total energy, or 1.2-1.5 g/kg body weight while reducing carbohydrates and fats to maintain lean mass, (Formisano et al., 2023; Magkos et al., 2021). Alternatively, VLCDs are characterized by a high fat content of 43-70% of total energy, moderate protein levels, and carbohydrate restriction of less than 13% of energy or less than 50 g/day to induce ketosis (Guarnotta et al., 2022). Furthermore, the very low-fat VLCD reduces fat intake to under 10% of total calories while increasing carbohydrate intake and maintaining protein levels at 0.8-1.2 g/kg of ideal body weight (Blankenship & Wolfe, 2006; Muscogiuri et al., 2021). Replacement-based meals to keep calories under control, VLCDs use pre-packaged goods like bars, soups, and shakes. (Saris, 2001).

Higher protein (1.5-2 g/kg) may be needed for athletes vs. obese patients (Janssen et al., 2023). The VLCD may be implanted for a brief duration of 2-3 months, subsequently followed by a gradual calorie increase in calorie intake to facilitate the transition to a balanced diet, supported by regular physical exercise for effective weight management, (Franz et al., 2007; Muscogiuri et al., 2021). However, compared to behavioral therapies alone, a study by Parretti et al. (2016) discovered that adding very-low-energy diets (VLEDs) to a behavioral program led to an extra 3.9 kg of weight loss after a year. After 24 months, the difference in weight loss was still 1.4 kg and between 38 and 60 months, it was 1.3 kg. These results imply that VLEDs are generally well-tolerated, have few side effects, and, when combined with behavioral support, can lead to more substantial long-term weight loss.

Micronutrient supplementation and fiber enrichment are often necessary to fulfill the nutritional requirements of VLCDs (Parretti et al., 2016). Although successful, VLCDs are contraindicated for individuals with certain medical conditions, including renal or liver disease, type 1 diabetes, pregnancy, breastfeeding, heart failure, eating disorders, and psychological disorders. Consequently, careful patient selection and close medical supervision are essential to optimize safety and efficacy (Muscogiuri et al., 2021).

Table 1: An overview of weight loss and weight plateau management dietary and non-dietary interventions

Reference	Design	Participants	Intervention	Outcome/Results	Conclusion
(Julie Kresta et al., 2020)	Intervention	Fifty sedentary and obese premenopausal females	1.) Exercise without diet intervention (EX); 2.) Exercise with a diet higher in carbohydrates (EX+HCD); or 3.) Exercise with a diet higher in protein (EX+HPD).	The participants' body weight significantly decreased. (EX - 2.24) (EX+HCD -6.99) (EX+HPD -4.49), fat mass (EX -3.45) (EX+HCD -12.15) (EX+HPD -8.54)	Weight and fat loss without plateauing can be achieved with a 30-day repeating nonlinear diet. Compared to HCD therapies, consuming an HPD may assist maintain fat-free mass during weight loss and enhance some health indicators.
(Sacks et al., 2009)	Randomized clinical trial	811 overweight adults	of four diets, with the following targeted percentages of calories coming from fat, protein, and carbs: 20, 15, and 65%; 20, 25, and 55%; 40, 15, and 45%; and 40, 25, and 35%.	Participants in all diet groups lost roughly 6 kg at 6 months, or 7% of their starting weight, but by 12 months, they had started to gain back. Regardless of the macronutrient ratios, weight reduction after two years was comparable at 3.0 vs. 3.6 kg for 15% vs. 25% protein, 3.3 kg for both 20% and 40% fat, and 2.9 vs. 3.4 kg for 65% vs. 35% carbs.	Whatever macronutrients are prioritized, reduced-calorie diets lead to clinically significant weight loss.
(Hall, 2024)	Mathematical Modeling Study	A validated mathematical model of energy metabolism and body composition dynamics was used	food restriction, tirzepatide 10 mg, semaglutide 2.4 mg, and procedures such as Roux-en-Y gastric bypass (RYGB) surgery.	The long-term effects of RYGB surgery were around twice as strong as those of tirzepatide and semaglutide, and more than three times stronger than food restriction. The appetite feedback control circuit was significantly decreased by all interventions except diet restriction, which led to a prolonged period of weight loss prior to the plateau.	When compared to diet restriction, glucagon-like peptide 1 (GLP-1) receptor agonism and RYGB surgery therapies have more long-lasting effects and disrupt the appetite feedback regulatory circuit that governs body weight.
(Peos et al., 2021)	Intervention	Twenty-six resistance-trained athletes	Intermittent energy restriction for 12 weeks	Following a one-week diet hiatus, resting energy expenditure increased modestly (from 7000 to 7200 kJ/day), whereas body weight and fat-free mass increased slightly (0.6 kg). Leg muscle endurance increased, but strength stayed constant. More fullness, pleasure, and	A one-week diet break enhanced mental clarity, decreased appetite and irritation, and improved leg muscular endurance.

				alertness were noted by the participants, along with decreased appetite and irritability.	
(Flynn et al. 1993)	Intervention	255 patients	26-week very-low-calorie diet program.	90% of patients initially experienced medically significant weight loss of 10%, and 33% continued to do so. All patients experienced an average initial weight loss of 21.4 kg and a sustained weight loss of 6.5 kg. Over twice as much weight loss was sustained by exercisers as by nonexercisers.	Some people can maintain medically meaningful weight loss 30 months after starting a very low-calorie diet program.
(Love et al., 2020)	Randomized control trial	A total of 27 males and females	~25% diet with less calories Five days of weekly calorie restriction were followed by two days in a row of increased carbohydrate (CHO) intake under Refeed RF. For seven weeks, the continuous group followed a rigorous calorie restriction. in addition to seven weeks of resistance training four days a week.	Although both groups experienced comparable decreases in body and fat mass, the RF group-maintained muscle and metabolism more successfully than the CN group, preserving fat-free mass, dry fat-free mass, and resting metabolic rate.	During calorie restriction, a two-day carbohydrate refeed maintains FFM, dry FFM, and RMR. This state is similar to ongoing energy restriction in RT persons.
(Keogh et al., 2014)	Randomized control trial	A continuous energy-restricted diet (CER) or an intermittent energy-restricted diet (IER) was randomly assigned to 75 women.	After one week of a 5500-kJ ER, the IER group resumed their regular diet. For the duration of the trial, the CER group continually followed a 5500-kJ ER. Over the course of the year, both groups were told to maintain a consistent level of exercise.	The CER and IER groups experienced comparable weight loss at 8 weeks and 12 months. There was also no difference in hip and waist measures. At 12 months, the CER group's Healthy Eating Index improved more than the others, suggesting higher-quality eating.	According to this study, intermittent dieting was just as successful in maintaining weight loss after 12 months as continuous dieting for 8 weeks. For those that find CER too challenging to maintain, this could be helpful.

(Byrne et al., 2018)	Randomized control trial	Fifty-one obese men with obesity were randomized	Energy restriction (ER) for 16 weeks was either (1) continuous (CON) or (2) intermittent (INT), with 8 × 2-week ER blocks interspersed with 7 × 2-week energy balancing blocks (30 weeks total).	While the fat-free mass loss was comparable, the intermittent restriction (INT) group shed more weight (14.1 kg vs. 9.1 kg) and fat mass (12.3 kg vs. 8.0 kg) than the continuous (CON) group. Throughout the INT balancing phases, weight stayed constant. After controlling for body composition, the INT group demonstrated superior metabolic adaptation, despite the fact that REE decreased in both.	More weight and fat was lost when intermittent ER was used. Energy balancing "rest periods" that interrupt the ER may lessen compensatory metabolic reactions, which would increase the effectiveness of weight loss.
(Seimon et al., 2015)	Systematic review	40 original articles	Thirty-one of the forty reviewed research looked at intermittent fasting (IF). Nineteen centered on alternate-day fasting (ADF), switching between unrestricted "feed days" and low-energy "fast days" (around 25% of demands). Twelve research employed extreme energy restriction during brief fasting periods (2–7 days per week). Only two used mild restriction throughout the intermittent energy restriction (IER) protocol's fasting phase, whereas seven investigated lengthier fasting durations (2–12 weeks in a row).	This systematic review's findings lend credence to the efficacy of intermittent energy restriction (IER) as a weight-loss strategy. Of the 40 publications analyzed, all but three reported weight loss; no cases of weight gain were found. Weight reduction ranged from 2.1 kg after 3 weeks to a maximum of 16.6 kg after 20 weeks, with the most common weight loss being 3–5 kg over about 10 weeks.	The majority of studies lacked enough information to determine whether intermittent fasting (IF) promotes weight reduction or inhibits adaptive reactions to energy restriction. On the other hand, IF improved glucose homeostasis, reduced body weight, fat mass, and fat-free mass, and may have reduced appetite in a manner comparable to that of continuous restriction. As a result, intermittent fasting (IF) is a legitimate weight loss method, although it is not better than consistent restriction.
(Volek et al., 2004)	Randomized clinical intervention trial	15 healthy, overweight/obese men and 13 premenopausal women	Two energy-restricted (-500 kcal/day) diets were prescribed to the subjects: a VLCK diet in order to reduce In order to induce ketosis, a low-fat LF diet seeks to keep carbohydrate levels below 10% of energy, which is comparable to	Body mass, total fat, and trunk fat decreased more in males following the VLCK diet than in women following the LF diet, but no discernible differences were seen. With VLCK, men also lost more trunk fat in comparison to total fat. On the VLCK diet, REE stayed constant, but with LF, it decreased.	According to this study, a VLCK diet clearly outperforms an LF diet for short-term weight and fat loss, particularly in men. Although it needs more research, a VLCK diet's preferential reduction of trunk fat is new and may have clinical significance.

			the national recommendations (%carbohydrate: fat: protein = ~60:25:15%).		
(Bellicha et al., 2021)	Systematic review	149 studies and 12 systematic reviews	Every original study contrasted exercise training with usual care or no intervention, or exercise training with other interventions (e.g., diet + exercise) and suitable controls (e.g., diet only).	Significant weight loss (1.5–3.5 kg), fat loss (1.3–2.6 kg), and visceral fat loss were all brought on by exercise. As long as the energy expenditure was the same, there were no differences between aerobic and high-intensity interval training. Exercise had no discernible impact on weight maintenance, although resistance training preserved lean mass (0.8 kg) during weight decrease.	These results demonstrate how fitness training helps adults who are overweight or obese lose weight and modify their body composition. Cardiometabolic health may improve from visceral fat removal. To find exercise methods that support weight maintenance, more investigation is required.
(Gripeteg et al., 2010)	A non-blinded, randomized, one-year clinical trial	269 patients	a 12-week initial very-low-energy diet (VLED) as part of a one-year obesity treatment program. Following VLED, patients who lost at least 10% of their body weight were randomized to either Group 1 (one week) or Group 6 (six weeks) of refeeding to a regular, energy-reduced diet. They were then monitored and treated for an additional forty weeks.	Group 6 experienced a considerably lower weight increase (3.9%) between weeks 12 and 52 than Group 1 (8.2%) among 169 individuals who lost $\geq 10\%$ of their body weight while following a very-low-energy diet (VLED). Although eating behavior changes were not statistically significant at week 52, patients who received six weeks of refeeding demonstrated improved dietary constraint.	After successfully losing weight with VLED, a longer refeeding period enhances weight maintenance over a one-year period.
(Jo et al., 2019)	Single-blind, randomized, parallel-group prospective trial.	Six male and five female participants	Morbidly obese individuals were divided into two groups: the control group (CON) and the resistance training (RT) group. They were given a very low-calorie diet (VLCD) (Optifast®) for 12 weeks, with supplemented protein (1120 kcal/day). While both groups engaged in a walking program based on pedometers,	Total body mass (TBM) and fat mass (FM) decreased significantly in both groups, with no discernible differences. But whilst the resistance training (RT) group maintained lean mass (LM), the control group (CON) lost 4.6 kg of LM. Additionally, RT lost less LM (4.0% vs. 24.4%) and a larger percentage of weight from fat (96%) than CON (75.6%). In CON, resting energy expenditure (REE) dropped dramatically,	In morbidly obese men and women following a protein-supplemented VLCD, resistance exercise improved weight-loss composition by maintaining LM without sacrificing total weight or fat loss.

			only RT engaged in resistance training three days a week for a total of twelve weeks. Serum biomarkers, neuromuscular function, body composition, and resting energy expenditure (REE) were evaluated at weeks 0, 6, and 13.	whereas in RT, it was mostly constant. Additionally, following therapy, RT's blood levels of glycerol, β -hydroxybutyrate, and free fatty acids increased, and their muscle strength and contractile function improved faster.	
(Malandrucco et al., 2012)	Intervention	14 patients with type 2 diabetes who are extremely obese (BMI, in kg/m ²) and have good glucose control (glycated hemoglobin, <7.5%)	The patient is on a VLCD for 7 days (400 kcal/d).	Weight reduction with the very low-calorie diet (VLCD) was 3.22%, with fat accounting for 42% of the weight loss. Triglycerides and fasting plasma glucose decreased along with the weight loss. Furthermore, while insulin sensitivity stayed constant, improvements in both first- and second-phase insulin production led to a considerable increase in the Disposition Index, which measures the body's capacity to regulate glucose.	After a 7-day VLCD, the metabolic profile of people with type 2 diabetes who were extremely overweight changed significantly. Their improved B cells were primarily responsible for this, while insulin sensitivity had no bearing.
(Saris, 2001)	Systematic review	14 study	VLCDs and low-calorie diets with an average intake between 400 and 800 kcal	Body weight loss with low-calorie diets (400–800 kcal/day) and very low-calorie diets (VLCDs) is comparable. Long-term weight maintenance, however, varies greatly; after one year, weight regain ranges from 27% to 122%, and after five years, it ranges from 26% to 121%. Research indicates that increased initial weight reduction with VLCDs enhances long-term weight maintenance when paired with an aggressive follow-up program that includes exercise, behavioral therapy, and nutritional education.	One of the more effective treatment approaches for long-term weight-maintenance success appears to be VLCD combined with active follow-up care.
(Franz et al., 2007)	Systematic review	Eighty studies	We identified eight categories of weight-loss interventions: diet plus exercise, diet alone, exercise alone,	During the first six months, weight-reduction drugs and reduced-energy diets resulted in a mean weight loss of 5–8.5 kg (5%–9%), with weight	At six months, weight-reduction treatments that involve exercise and a reduced-energy diet are linked to moderate

			meal replacements, very-low-energy diets, weight-loss drugs (sibutramine and orlistat), and counsel alone.	plateaus occurring at roughly six months. Participants in studies that lasted up to 48 months sustained an average weight loss of 3 to 6 kg (3% to 6%), with no return to baseline. The exercise-alone and advice-only groups, on the other hand, did not lose much weight during the intervention.	weight loss. Weight loss can be sustained even if there is some weight gain. Weight-loss maintenance is somewhat improved with the inclusion of weight-loss drugs.
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3.2.5 Low-fat diet

Reducing overall fat consumption is a popular weight loss tactic since one gram of fat has more calories than one gram of protein or carbohydrates. Very low (less than 10% of calories) to moderate (less than 30% of calories from fat and less than 7%–10% from saturated fatty acids) fat content is the norm for a low-fat diet. While randomized trials have shown that low-fat diets can be as effective as other interventions for initial weight loss (Sacks et al., 2009). Their long-term efficacy is limited. A meta-analysis found that reducing dietary fat did not improve weight-loss maintenance more than other dietary strategies, likely due to compensatory increases in carbohydrate intake that offset the calorie deficit (Kim, 2021).

3.3 Surgical approaches and pharmacological treatments

Pharmacological treatment or surgical interventions are considered when lifestyle modifications and adherence to a low-calorie diet, with increased physical activity, don't succeed in achieving sufficient weight loss despite prolonged compliance with these measures for a considerable period (Cannon & Kumar, 2009). Medications are usually given to patients who do not achieve consistent, steady improvement through non-invasive methods, whereas surgery is intended for people who suffer from severe obesity or obesity accompanied by co-morbidities, necessitating significant and sustained weight loss interventions for managing medical problems (Bray and Ryan, 2021). Pharmacological treatments, such as GLP-1 receptor agonists, can help people who have a body mass index (BMI) of 30 kg/m² or more than 27 kg/m² and other obesity-related health issues lose more weight in a long-term, less invasive manner. However, these agents may cause side effects such as nausea, vomiting, or gastrointestinal discomfort, particularly during dose escalation (Filippatos et al., 2014). People with a body mass index (BMI) of 40 kg/m² or a BMI of 35 kg/m² or more and severe comorbidities should consider bariatric procedures. These procedures help people achieve long-term weight loss but require a more invasive approach. The selection of therapies should reflect the health status, previous weight-reduction efforts, risk-benefit analysis, and patient preferences, guaranteeing a customized and effective approach (Hall, 2024).

The many methods for breaking weight plateaus are highlighted in this review, with a focus on the fact that customized approaches produce the best outcomes. Research shows that dietary interventions, such as high-protein diets, ketogenic diets, and very low-calorie diets (VLCDs), can help people overcome plateaus. This is especially true when paired with behavioral strategies like motivational interviewing, (Parretti et al., 2016; Seimon et al., 2015). Furthermore, intermittent energy restriction (IER) and changes in meal timing have demonstrated potential for enhancing adherence and optimizing metabolic responses (Byrne et al., 2018; Peos et al., 2021). Exercise interventions, particularly resistance training, support long-term weight loss by reducing metabolic adaptation and preserving lean mass (Bellicha et al., 2021). Bariatric surgery and pharmaceutical treatments are still viable options in more resistant cases (Hall, 2024). For long-term weight management and plateau breaking, all the research suggests that a mix of behavioral support, scheduled exercise, and targeted food adjustments is required.

Limitations

This review is subject to certain limitations, including language bias (English only studies) and narrative review design. Additionally, incorporating review papers may provide redundant data; however, they were considered for summarizing comprehensive insights inside this publication. Future studies should give special attention to carefully planned randomized controlled trials and meta-analyses that contrast various dietary approaches (such as intermittent vs continuous energy restriction) in a range of populations, especially those with metabolic disorders linked to obesity. To better understand the mechanisms determining sustained outcomes, studies should evaluate not only weight reduction but also long-term maintenance, metabolic adaptations, and psychological adherence variables. Moreover, by restricting the scope of evidence to nations with a large English-speaking population and maybe omitting pertinent data from varied populations or locations, excluding non-English studies may cause linguistic bias. This may lead to an overrepresentation of those outcomes that are more commonly reported in English-language

publications, a distorted understanding of the subject, and less generalizability.

Table 2. Types and macronutrients of very-low-calorie diets

Type of VLCD	Carbohydrate	Protein	Fat	Total calories and duration
Standard VLCD	30–50 g/day (13–25%)	0.8–1.2 g/kg IBW (~40–45%)	15–30 g/day (~40–45%)	
Protein-Sparing Modified Fast (PSMF)	Minimal (<10% of calories)	1.2–1.5 g/kg IBW (~40–50%)	Minimal (<10% of calories)	
Very Low-Fat VLCD	Increased (>40% of calories)	0.8–1.2 g/kg IBW	<10% of calories	500-800 kcal 2-3 months*
Very Low-Calorie Ketogenic Diet (VLCKD)	<50 g/day (<13% of calories)	Moderate (~20–30% of calories)	55–70% of calories	
Meal Replacement-Based VLCD	Varies (balanced macronutrient ratios)	~40–45% of calories	~40–45% of calories	

“Macronutrient values are presented as ranges and are not expected to sum to exactly 100%.”

*This kcal range and duration applies to all types of VLCD diets

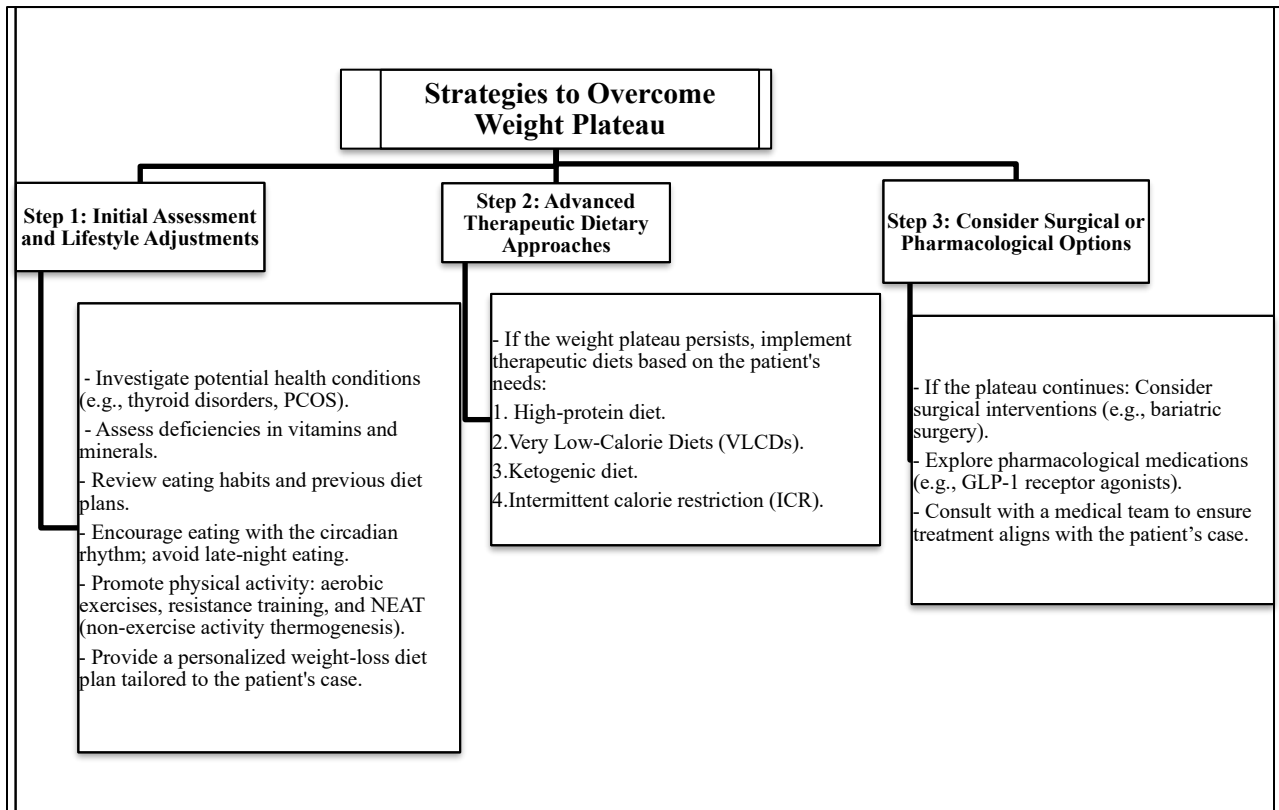


Fig.2. The strategies to overcome weight plateau

4. CONCLUSION

A WP presents an annoying obstacle in weight loss management, frequently resulting in frustration and reduced motivation to persist with a low-calorie diet among individuals. This challenge can hinder their adherence to dietary and exercise regimes, potentially leading to binge eating as a response to feelings of failure and frustration. Dietitians and healthcare professionals have to address the WP issue and use motivational interviewing techniques with structured nutritional and health education to sustain engagement and commitment. A gradual reduction in caloric intake while preserving a nutritionally balanced diet and increasing physical activity should be the first dietary intervention, addressing any health condition that may hinder weight reduction. Should WP manifest, other methods, such as intermittent fasting, may be employed. When supervised properly, short-term therapeutic diets like VLCDs, ICR, high-protein diets, or ketogenic diets may help with WP. These diets should be followed by a gradual return of calories to help with long-term weight stability. Nevertheless, physical activity plays a crucial part in weight reduction, including both aerobic and resistance training to preserve muscle mass and enhance NEAT. Consistent weight maintenance is often associated with active lifestyle modifications and continuous involvement in customized weight management programs.

Future studies are advised to compare various dietary strategies for WPs in randomized controlled trials, examine long-term adherence to ICR and ketogenic diets, and evaluate the effectiveness of behavioral and nutritional interventions in combination to overcome WPs.

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DATA AVAILABILITY STATEMENT

Not applicable. This is a narrative review based on previously published literature, and no new data were generated or analyzed.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to this work.

ABBREVIATIONS

ADF	—Alternate-Day Fasting
BM	—Body Mass
BMI	—Body Mass Index
CER	—Continuous Energy Restricted Diet
CHO	—Carbohydrate
CON	—Continuous Energy Restriction
dFFM	—Dry Fat-Free Mass
ER	—Energy Restriction
EX	—Exercise plus No Diet Intervention
EX+HCD	—Exercise plus Higher Carbohydrate Diet
EX+HPD	—Exercise plus Higher Protein Diet
FFM	—Fat-Free Mass
FM	—Fat Mass
GLP	—Glucagon-Like Peptide
HIT	—High-Intensity Training
ICR	—Intermittent Caloric Restriction
IER	—Intermittent Energy Restricted Diet
LF	—Low-Fat Diet
MA	—Metabolic Adaptation
MICT	—Moderate-Intensity Continuous Training
NEAT	—Non-Exercise Activity Thermogenesis
PSMF	—Protein-Sparing Modified Fast
REE	—Resting Energy Expenditure
RMR	—Resting Metabolic Rate
RT	—Resistance Training
RYGB	—Roux-en-Y Gastric Bypass
VLED	—Very Low-Energy Diet
VLCD	—Very Low-Calorie Diet
VLCK	—Very Low-Carbohydrate Ketogenic Diet
WP	—Weight Plateau

REFERENCES

- Aaseth, J., Ellefsen, S., Alehagen, U., SundfØr, T. M., & Alexander, J. (2021). Diets and drugs for weight loss and health in obesity – An update. *Biomedicine & Pharmacotherapy*, 140, 111789. <https://doi.org/10.1016/j.biopha.2021.111789>
- Alharbi, A., & Al-Sowayan, N. S. (2020). The effect of ketogenic-diet on health. *Food and Nutrition Sciences*, 11(04), 301–313. <https://doi.org/10.4236/fns.2020.114022>
- Atkinson, R. L., Dietz, W. H., Foreyt, J. P., Goodwin, N. J., Hill, J. O., Hirsch, J., Sunyer, F. X., Weinsier, R. L., Wing, R., Yanovski, S. Z., Hubbard, V. S., & Hoofnagle, J. H. (1993). Very low-calorie diets. *JAMA: The Journal of the American Medical Association*, 270(8), 967–974. <https://doi.org/10.1001/jama.1993.03510080071034>
- Barnes, R. D., & Ivezaj, V. (2015). A systematic review of motivational interviewing for weight loss among adults in primary care. *Obesity reviews*, 16(4), 304–318. <https://doi.org/10.1111/obr.12264>
- Bellicha, A., van Baak, M. A., Battista, F., Beaulieu, K., Blundell, J. E., Busetto, L., Carraça, E. V., Dicker, D., Encantado, J., Ermolao, A., Farpour-Lambert, N., Pramono, A., Woodward, E., & Oppert, J. M. (2021). Effect of exercise training on weight loss, body composition changes, and weight maintenance in adults with overweight or obesity: An overview of 12 systematic reviews and 149 studies. *Obesity Reviews*, 22(S4). <https://doi.org/10.1111/obr.13256>
- Blankenship, J. D., & Wolfe, B. M. (2006). Dietary management of obesity. In Buchwald, H., & Pories, W. J. (Eds.), *Surgical Management of Obesity* (pp. 67–72). Elsevier. <https://doi.org/10.1016/B978-1-4160-0089-1.50014-5>
- Bray, G. A., & Ryan, D. H. (2021). Evidence-based weight loss interventions: Individualized treatment options to maximize patient outcomes. *Diabetes, Obesity and Metabolism*, 23(S1), 50–62. <https://doi.org/10.1111/dom.14200>
- Byrne, N. M., Sainsbury, A., King, N. A., Hills, A. P., & Wood, R. E. (2018). Intermittent energy restriction improves weight loss efficiency in obese men: The MATADOR study. *International Journal of Obesity*, 42(2), 129–138. <https://doi.org/10.1038/ijo.2017.206>
- Calcagno, M., Kahleova, H., Alwarith, J., Burgess, N. N., Flores, R. A., Busta, M. L., & Barnard, N. D. (2019). The thermic effect of food: A Review. *Journal of the American College of Nutrition*, 38(6), 547–551. <https://doi.org/10.1080/07315724.2018.1552544>
- Campbell, B., Kreider, R. B., Ziegenfuss, T., La Bounty, P., Roberts, M., Burke, D., Landis, J., Lopez, H., & Antonio, J. (2007). International society of sports nutrition position stand: protein and exercise. *Journal of the International Society of Sports Nutrition*, 4(1). <https://doi.org/10.1186/1550-2783-4-8>
- Cannon, C. P., & Kumar, A. (2009). Treatment of overweight and obesity: lifestyle, pharmacologic, and surgical options. *Clinical cornerstone*, 9(4), 55–71.
- Chaput, J. P., Klingenberg, L., Rosenkilde, M., Gilbert, J. A., Tremblay, A., & Sjödín, A. (2011). Physical activity plays an important role in body weight regulation. *Journal of Obesity*, 2011. <https://doi.org/10.1155/2011/360257>
- Cortez, F. M., Nunes, C. L., Sardinha, L. B., Silva, A. M., & Teixeira, V. H. (2023). The BREAK study protocol: Effects of intermittent energy restriction on adaptive thermogenesis during weight loss and its maintenance. *Plos one*, 18(11), e0294131. <https://doi.org/10.1371/journal.pone.0294131>
- Cunningham, E. (2011). How can I help my client who is experiencing a weight-loss plateau? *Journal of the American Dietetic Association*, 111(12), 1966. <https://doi.org/10.1016/j.jada.2011.10.020>
- de Assis, G. G., & Murawska-Ciałowicz, E. (2023). Exercise and weight management: the role of leptin—a systematic review and update of clinical data from 2000–2022. *Journal of clinical medicine*, 12(13), 4490.
- Dowis, K., & Banga, S. (2021). The Potential health benefits of the ketogenic diet: A narrative review. *Nutrients*, 13(5), 1654. <https://doi.org/10.3390/nu13051654>
- Escalante, G., Campbell, B. I., & Norton, L. (2020). Effectiveness of diet refeeds and diet breaks as a precontest strategy. *Strength and Conditioning Journal*, 42(5), 102–107. <https://doi.org/10.1519/SSC.0000000000000546>
- Filippatos, T. D., Panagiotopoulou, T. V., & Elisaf, M. S. (2014). Adverse effects of GLP-1 receptor agonists. *The Review of Diabetic Studies*, 11(3–4), 202–230. <https://doi.org/10.1900/RDS.2014.11.202>
- Flynn, T. J., & Walsh, M. F. (1993). Thirty-month evaluation of a popular very-low-calorie diet program. *Arch Fam Med*, 2(10), 1042–8.
- Formisano, E., Schiavetti, I., Gradaschi, R., Gardella, P., Romeo, C., Pisciotta, L., & Sukkar, S. G. (2023). The real-life use of a protein-sparing modified fast diet by nasogastric tube (ProMoFasT) in Adults with Obesity: An Open-Label Randomized Controlled Trial. *Nutrients*, 15(22), 4822. <https://doi.org/10.3390/nu15224822>
- Franz, M. J., VanWormer, J. J., Crain, A. L., Boucher, J. L., Histon, T., Caplan, W., Bowman, J. D., & Pronk, N. P. (2007). Weight-Loss Outcomes: A systematic review and meta-analysis of weight-loss clinical trials with a minimum

- 1-year follow-up. *Journal of the American Dietetic Association*, 107(10), 1755–1767. <https://doi.org/10.1016/j.jada.2007.07.017>
- Garofalo, C., Borrelli, S., Minutolo, R., Chiodini, P., De Nicola, L., & Conte, G. (2017). A systematic review and meta-analysis suggests obesity predicts onset of chronic kidney disease in the general population. *Kidney International*, 91(5), 1224–1235. <https://doi.org/10.1016/j.kint.2016.12.013>
- Gripeteg, L., Torgerson, J., Karlsson, J., & Lindroos, A. K. (2010). Prolonged refeeding improves weight maintenance after weight loss with very-low-energy diets. *British Journal of Nutrition*, 103(1), 141–148. <https://doi.org/10.1017/S0007114509991474>
- Gropper, S. S. (2023). The role of nutrition in chronic disease. *Nutrients*, 15(3), 664. MDPI. <https://doi.org/10.3390/nu15030664>
- Guarnotta, V., Emanuele, F., Amodei, R., & Giordano, C. (2022). Very low-calorie ketogenic diet: a potential application in the treatment of hypercortisolism comorbidities. *Nutrients*, 14(12), 2388. MDPI. <https://doi.org/10.3390/nu14122388>
- Hall, K. D. (2024). Physiology of the weight-loss plateau in response to diet restriction, GLP-1 receptor agonism, and bariatric surgery. *Obesity*, 32(6), 1163–1168. <https://doi.org/10.1002/oby.24027>
- Hall, K. D., & Kahan, S. (2018). Maintenance of lost weight and long-term management of obesity. *Medical Clinics*, 102(1), 183–197. <https://doi.org/10.1016/j.mcna.2017.08.012>
- Jabbour, J., Rihawi, Y., Khamis, A. M., Ghamlouche, L., Tabban, B., Safadi, G., Hammad, N., Hadla, R., Zeidan, M., Andari, D., Azar, R.N., Nasser, N., & Chakhtoura, M. (2022). Long term weight loss diets and obesity indices: results of a network meta-analysis. *Frontiers in Nutrition*, 9, 821096.
- Jäger, R., Kerksick, C. M., Campbell, B. I., Cribb, P. J., Wells, S. D., Skwiat, T. M., Purpura, M., Ziegenfuss, T. N., Ferrando, A. A., Arent, S. M., Smith-Ryan, A. E., Stout, J. R., Arciero, P. J., Ormsbee, M. J., Taylor, L. W., Wilborn, C. D., Kalman, D. S., Kreider, R. B., Willoughby, D. S., Hoffman, J.R., Krzykowski, J.L., Antonio, J. (2017). International society of sports nutrition position stand: protein and exercise. *Journal of the International Society of Sports Nutrition*, 14(1). <https://doi.org/10.1186/s12970-017-0177-8>
- Janssen, T. A. H., Van Every, D. W., & Phillips, S. M. (2023). The impact and utility of very low-calorie diets: the role of exercise and protein in preserving skeletal muscle mass. *Current Opinion in Clinical Nutrition & Metabolic Care*, 26(6), 521–527. <https://doi.org/10.1097/MCO.0000000000000980>
- Jo, E., Worts, P. R., Elam, M. L., Brown, A. F., Khamoui, A. V., Kim, D. H., Yeh, M. C., Ormsbee, M. J., Prado, C. M., Cain, A., Snyder, K., & Kim, J. S. (2019). Resistance training during a 12-week protein supplemented VLCD treatment enhances weight-loss outcomes in obese patients. *Clinical Nutrition*, 38(1), 372–382. <https://doi.org/10.1016/j.clnu.2017.12.015>
- Johns, D. J., Hartmann-Boyce, J., Jebb, S. A., & Aveyard, P. (2014). Diet or exercise interventions vs combined behavioral weight management programs: A systematic review and meta-analysis of direct comparisons. *Journal of the Academy of Nutrition and Dietetics*, 114(10), 1557–1568. <https://doi.org/10.1016/j.jand.2014.07.005>
- Kresta, J., Byrd, M., Oliver, J. M., Baetge, C. C., Mardock, M., Simbo, S., Jung, Y.P., Koozehchian, M., Khanna, D., Lockard, B., Dalton, R., Rasmussen, C., & Kreider, R. B. (2020). Effects of energy and macronutrient cycling on weight loss, body composition, and markers of health in obese women participating in a resistance-based exercise program. *Medical Research Archives*, 8(6).
- Kaikkonen, K. M., Saltevo, S. S., Korpelainen, J. T., Vanhala, M. L., Jokelainen, J. J., Korpelainen, R. I., & Keinänen-Kiukaanniemi, S. M. (2019). Effective weight loss and maintenance by intensive start with diet and exercise. *Medicine & Science in Sports & Exercise*, 51(5), 920–9.
- Keogh, J. B., Pedersen, E., Petersen, K. S., & Clifton, P. M. (2014). Effects of intermittent compared to continuous energy restriction on short-term weight loss and long-term weight loss maintenance. *Clinical Obesity*, 4(3), 150–156. <https://doi.org/10.1111/cob.12052>
- Kheniser, K., Saxon, D. R., & Kashyap, S. R. (2021). Long-term weight loss strategies for obesity. *The Journal of Clinical Endocrinology & Metabolism*, 106(7), 1854–1866. <https://doi.org/10.1210/clinem/dgab091>
- Kim, J. Y. (2020). Optimal diet strategies for weight loss and weight loss maintenance. *Journal of obesity & metabolic syndrome*, 30(1), 20. <https://doi.org/10.7570/JOMES20065>
- Ko, G.-J., Rhee, C. M., Kalantar-Zadeh, K., & Joshi, S. (2020). The effects of high-protein diets on kidney health and longevity. *Journal of the American Society of Nephrology*, 31(8), 1667–1679. <https://doi.org/10.1681/ASN.2020010028>
- Landry, M. J., Ward, C. P., Cunanan, K. M., Fielding-Singh, P., Crimarco, A., & Gardner, C. D. (2024). Switching diets after 6-months does not result in renewed weight loss: a secondary analysis of a 12-month crossover randomized trial. *Scientific Reports*, 14(1). <https://doi.org/10.1038/s41598-024-60547-z>

- Lee, V. (2023). Introduction to the dietary management of obesity in adults. *Clinical Medicine, Journal of the Royal College of Physicians of London*, 23(4), 304–310. <https://doi.org/10.7861/clinmed.2023-0157>
- Love, P., Walsh, M., & Campbell, K. J. (2020). Knowledge, attitudes and practices of australian trainee childcare educators regarding their role in the feeding behaviours of young children. *International Journal of Environmental Research and Public Health*, 17(10), 3712. <https://doi.org/10.3390/ijerph17103712>
- MacLean, P. S., Bergouignan, A., Cornier, M. A., & Jackman, M. R. (2011). Biology's response to dieting: The impetus for weight regain. In *American Journal of Physiology - Regulatory Integrative and Comparative Physiology*, 301(3). <https://doi.org/10.1152/ajpregu.00755.2010>
- Magkos, F., Hjorth, M. F., Asping, S., Rosenkrans, M. I., Rasmussen, S. I., Ritz, C., Sjödin, A., & Geiker, N. R. W. (2021). A protein-supplemented very-low-calorie diet does not mitigate reductions in lean mass and resting metabolic rate in subjects with overweight or obesity: A randomized controlled trial. *Clinical Nutrition*, 40(12), 5726–5733. <https://doi.org/10.1016/j.clnu.2021.10.006>
- Makin, H., Chisholm, A., Fallon, V., & Goodwin, L. (2021). Use of motivational interviewing in behavioural interventions among adults with obesity: A systematic review and meta-analysis. In *Clinical Obesity*, Vol. 11(4). John Wiley and Sons Inc. <https://doi.org/10.1111/cob.12457>
- Malandrullo, I., Pasqualetti, P., Giordani, I., Manfellotto, D., De Marco, F., Alegiani, F., Sidoti, A. M., Picconi, F., Di Flaviani, A., Frajese, G., Bonadonna, R. C., & Frontoni, S. (2012). Very-low-calorie diet: A quick therapeutic tool to improve β cell function in morbidly obese patients with type 2 diabetes. *American Journal of Clinical Nutrition*, 95(3), 609–613. <https://doi.org/10.3945/ajcn.111.023697>
- Martínez-Gómez, M. G., & Roberts, B. M. (2022). Metabolic adaptations to weight loss: a brief review. *The Journal of Strength & Conditioning Research*, 36(10), 2970–2981. <https://doi.org/10.1519/JSC.0000000000003991>
- McHill, A. W., Thosar, S. S., Bowles, N. P., Butler, M. P., Ordaz-Johnson, O., Emens, J. S., Purnell, J. Q., Gillingham, M., & Shea, S. A. (2024). Obesity alters the circadian profiles of energy metabolism and glucose regulation in humans. *Obesity*, 32(2), 315–323. <https://doi.org/10.1002/oby.23940>
- Montesi, L., El Ghoch, M., Brodosi, L., Calugi, S., Marchesini, G., & Dalle Grave, R. (2016). Long-term weight loss maintenance for obesity: a multidisciplinary approach. *Diabetes, metabolic syndrome and obesity: targets and therapy*, 37–46. <https://doi.org/10.2147/DMSO.S89836>
- Moon, J., & Koh, G. (2020). Clinical evidence and mechanisms of high-protein diet-induced weight loss. *Journal of obesity & metabolic syndrome*, 29(3), 166. <https://doi.org/10.7570/jomes20028>
- Morsali, M., Poorolajal, J., Shahbazi, F., Vahidinia, A., & Doosti-Irani, A. (2021). Diet therapeutics interventions for obesity: a systematic review and network meta-analysis. *Journal of Research in Health Sciences*, 21(3), e00521–e00521. <https://doi.org/10.34172/jrhs.2021.63>
- Muscogiuri, G., Pugliese, G., Laudisio, D., Castellucci, B., Barrea, L., Savastano, S., & Colao, A. (2021). The impact of obesity on immune response to infection: Plausible mechanisms and outcomes. *Obesity Reviews*, 22(6). <https://doi.org/10.1111/obr.13216>
- Ochner, C. N., Barrios, D. M., Lee, C. D., & Pi-Sunyer, F. X. (2013). Biological mechanisms that promote weight regain following weight loss in obese humans. *Physiology and Behavior*, 120, 106–113. <https://doi.org/10.1016/j.physbeh.2013.07.009>
- Palmer, A. K., & Jensen, M. D. (2022). Metabolic changes in aging humans: current evidence and therapeutic strategies. *The Journal of clinical investigation*, 132(16). <https://doi.org/10.1172/JCI158451>
- Parretti, H. M., Jebb, S. A., Johns, D. J., Lewis, A. L., Christian-Brown, A. M., & Aveyard, P. (2016). Clinical effectiveness of very-low-energy diets in the management of weight loss: A systematic review and meta-analysis of randomized controlled trials. *Obesity Reviews*, 17(3), 225–234. <https://doi.org/10.1111/obr.12366>
- Peos, J. J., Helms, E. R., Fournier, P. A., Krieger, J., & Sainsbury, A. (2021). A 1-week diet break improves muscle endurance during an intermittent dieting regime in adult athletes: A pre-specified secondary analysis of the ICECAP trial. *PLoS ONE*, 16(2). <https://doi.org/10.1371/journal.pone.0247292>
- Peos, J. J., Norton, L. E., Helms, E. R., Galpin, A. J., & Fournier, P. (2019). Intermittent dieting: theoretical considerations for the athlete. *Sports*, 7(1), 22. <https://doi.org/10.3390/sports7010022>
- Phelan, S., Halfman, T., Pinto, A. M., & Foster, G. D. (2020). Behavioral and Psychological Strategies of Long-Term Weight Loss Maintainers in a Widely Available Weight Management Program. *Obesity*, 28(2), 421–428. <https://doi.org/10.1002/oby.22685>
- Queiroz, J. do N., Macedo, R. C. O., Tinsley, G. M., & Reischak-Oliveira, A. (2020). Time-restricted eating and circadian rhythms: the biological clock is ticking. In *Critical Reviews in Food Science and Nutrition* 61(17), 2863–2875. Taylor and Francis Inc. <https://doi.org/10.1080/10408398.2020.1789550>

- Rosenbaum, M., & Leibel, R. L. (2010). Adaptive thermogenesis in humans. *International Journal of Obesity*, 34(S1), S47–S55. <https://doi.org/10.1038/ijo.2010.184>
- Sacks, F. M., Bray, G. A., Carey, V. J., Smith, S. R., Ryan, D. H., Anton, S. D., Mcmanus, K., Champagne, C. M., Bishop, L. M., Laranjo, N., Leboff, M. S., Rood, J. C., De Jonge, L., Greenway, F. L., Loria, C. M., Obarzanek, E., & Williamson, D. A. (2009). Comparison of weight-loss diets with different compositions of fat, protein, and carbohydrates. *New England Journal of Medicine* 360, no. 9 (2009): 859-873.
- Saris, W. H. (2001). Very-low-calorie diets and sustained weight loss. *Obesity research*, 9(S11), 295S-301S. <https://doi.org/10.1038/oby.2001.134>
- Seimon, R. V., Roekenes, J. A., Zibellini, J., Zhu, B., Gibson, A. A., Hills, A. P., Wood, R. E., King, N. A., Byrne, N. M., & Sainsbury, A. (2015). Do intermittent diets provide physiological benefits over continuous diets for weight loss? A systematic review of clinical trials. *Molecular and Cellular Endocrinology*, 418, 153–172. <https://doi.org/10.1016/j.mce.2015.09.014>
- Singar, S., Nagpal, R., Arjmandi, B. H., & Akhavan, N. S. (2024). Personalized nutrition: tailoring dietary recommendations through genetic insights. *Nutrients*, 16(16), 2673. <https://doi.org/10.3390/nu16162673>
- Speakman, J. R., & Hall, K. D. (2023). Models of body weight and fatness regulation. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 378(1888). <https://doi.org/10.1098/rstb.2022.0231>
- Thomas, D. M., Martin, C. K., Redman, L. M., Heymsfield, S. B., Lettieri, S., Levine, J. A., Bouchard, C., & Schoeller, D. A. (2014). Effect of dietary adherence on the body weight plateau: A mathematical model incorporating intermittent compliance with energy intake prescription. *American Journal of Clinical Nutrition*, 100(3), 787–795. <https://doi.org/10.3945/ajcn.113.079822>
- VanWormer, J. J., & Boucher, J. L. (2004). Motivational interviewing and diet modification: a review of the evidence. *The Diabetes Educator*, 30(3), 404–419. <https://doi.org/10.1177/014572170403000309>
- Volek, J. S., Sharman, M. J., Gómez, A. L., Judelson, D. A., Rubin, M. R., Watson, G., Sokmen, B., Silvestre, R., French, D. N., & Kraemer, W. J. (2004). Comparison of energy-restricted very low-carbohydrate and low-fat diets on weight loss and body composition in overweight men and women. *Nutrition and Metabolism*, 1. <https://doi.org/10.1186/1743-7075-1-13>
- Wu, X., Zhang, C., Liang, Z., Liang, Y., Li, Y., & Qiu, J. (2024). Exercise combined with a low-calorie diet improves body composition, attenuates muscle mass loss, and regulates appetite in adult women with high body fat percentage but normal BMI. *Sports*, 12(4). <https://doi.org/10.3390/sports12040091>