REVIEW ARTICLE

Meal Replacement Plans in Managing Adolescent Obesity: A Systematic Literature Review

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ABSTRACT

Background: Adolescent obesity remains a significant public health issue, with rising prevalence and long-term health risks. While lifestyle modifications are the primary treatment, their effectiveness is often limited. Meal Replacement Plans (MRPs) have emerged as a potential alternative, though evidence in adolescents remains unclear. **Objective:** This systematic review aimed to assess the effectiveness, sustainability, and safety of MRPs in managing obesity among adolescents. **Method:** A systematic search was conducted across PubMed, Scopus, and Cochrane Library for studies published between 2013 and 2024. Eligible studies included randomised controlled trials, pilot trials, and cohort studies involving adolescents aged 10–18 years who were overweight or obese. Data on intervention design, weight loss outcomes, sustainability, and side effects were extracted and synthesised narratively. **Results:** Seven studies with sample sizes ranging from 30 to 2,825 adolescents were included. MRPs, delivered as very-low-energy diets or partial replacement regimens, consistently produced short-term weight reduction (3.4–6.3% BMI decrease within 4–12 weeks). Adjunctive supports, including caregiver involvement, pharmacologic agents (e.g., exenatide), and financial incentives, enhanced outcomes. However, long-term sustainability was mixed; several trials showed weight regain after 12 months, while caregiver engagement and digital health tools demonstrated potential for maintaining weight loss. Side effects were generally mild (e.g., hunger, fatigue, nausea) and transient, with no adverse impact on growth reported. **Conclusion:** MRPs are effective for short-term weight reduction in adolescents with obesity and may be most beneficial when integrated with behavioral therapy, caregiver participation, or pharmacologic support. Their long-term sustainability remains uncertain, underscoring the need for extended follow-up studies.

INTRODUCTION

Background

Adolescence is defined as the period between 10 and 19 years of age, and is a crucial developmental phase characterised by rapid physical growth, psychological development, and increasing independence in making health-related decisions (World Health Organization, 2024). At this age, unhealthy eating patterns such as meal skipping, with increased sedentary behaviour and reduced physical activity often begin, contributing to excessive weight gain. Together with hormonal and psychosocial changes, these lifestyle patterns heighten the risk of overweight and obesity (De Lorenzo et al., 2019; Yamada et al., 2023).

Although not classified as a disease in itself, obesity is a major risk factor for chronic conditions. Among children and adolescents aged 5–19 years, the World Health Organization (WHO) defines overweight and obesity using the BMI-for-age chart: overweight is above +1 SD and obesity above +2 SD relative to the WHO Growth Reference median (World Health Organization, 2024). For adults (≥18 years), cut-offs are ≥25 kg/m² for overweight and ≥30 kg/m² for obesity. At the same time, ASEAN-specific thresholds are slightly lower (≥23 kg/m² for overweight and ≥27.5 kg/m² for obesity), which apply to adults (CPG for the Management of Obesity, 2023).

The global prevalence of adolescent obesity has risen dramatically. According to the WHO (2024), obesity among adolescents has quadrupled since 1990. In 2022,

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Over 390 million children and adolescents (5–19 years) were overweight, of whom 160 million were obese. In Malaysia, the National Health and Morbidity Survey (NHMS) 2022 reported overweight and obesity rates of 16.2% and 14.3%, respectively, among adolescents (Institute for Public Health (IPH), 2022). These figures signal a pressing public health concern requiring urgent action.

Obesity results from a persistent energy imbalance, where energy intake exceeds energy expenditure, leading to the accumulation of fat (Oussaada et al., 2019). For adolescents, this is often linked to high-calorie diets, sedentary lifestyles, and environmental or genetic predispositions. If untreated, obesity can lead to serious health complications, including type 2 diabetes mellitus (T2DM), hypertension, dyslipidemia, cardiovascular disease, stroke, sleep apnoea, and certain cancers (Evans et al., 2023; Lee, 2015).

Lifestyle interventions, such as dietary changes, physical activity, behavioural therapy, and family- or school-based programs, are the first-line treatment for adolescent obesity. While widely implemented, these interventions often have limited effectiveness in severely obese adolescents (Astbury et al., 2019). One promising dietary approach is the use of Meal Replacement Plans (MRPs), which involve substituting one or more daily meals with nutritionally balanced products such as shakes, bars, or prepared meals. MRPs simplify calorie control and are typically rich in protein and fibre to promote satiety (Astbury et al., 2019).

While commonly used in adults, emerging evidence suggests potential effectiveness in adolescents, particularly those with severe obesity or poor response to conventional lifestyle strategies. However, concerns remain regarding long-term sustainability, nutrient adequacy, and safety in this age group. Thus, this systematic review aims to evaluate the efficacy, safety, and sustainability of MRPs in the management of adolescent obesity.

METHODOLOGY

A systematic literature review (SLR) was conducted to synthesise evidence on meal replacement plans (MRPs) for adolescent obesity, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page et al., 2021). This design was chosen for its methodological rigour, ability to appraise study quality, and stronger evidence synthesis compared to scoping reviews (Mohamed Shaffril et al., 2021; Alexander, 2020).

A comprehensive search was conducted in PubMed, Scopus, and the Cochrane Library, utilising Boolean operators (AND, OR, NOT) and Medical Subject Headings (MeSH) to refine the retrieval. Search terms were structured using the Population, Intervention, Comparison, Outcomes, and Study Design (PICOS) framework (Table 1) (Amir-Behghadami & Janati, 2020). Table 2 describes the inclusion and exclusion criteria for the review. Eligible studies included adolescents aged 10–18 years with obesity (BMI ≥35 kg/m²) and interventions involving MRPs. Outcomes of interest were weight reduction, sustainability, and side effects. Cross-sectional, case-control, cohort studies, randomised controlled trials (RCTs), and quasi-experimental studies were included, while reviews, opinion papers, animal studies, and studies with unrelated outcomes were excluded. Articles were screened for titles, abstracts, and full texts, independently by the researcher, with duplicates removed using Mendeley. Only studies meeting the inclusion criteria were qualitatively synthesized.

Table 1: Search Strings

Category	Search Term
Population	(“Obes*” OR “Overweight” OR “Excessive weight” OR “Adiposity”) AND (“Adolescen*” OR “Child*” OR “Teen*” OR “Youth”) OR “Adolescent obesity” OR “Youth obesity” OR “Teen obesity”
Intervention	“Meal replacement*” OR {“Meal replacement” AND (“plan*” OR “therap*)} OR “MRP” OR “MRT” OR "Diet replacement" OR "Partial meal replacement" OR "Liquid diet" OR "Formula diet" OR "Nutritional replacement" OR "Dietary replacement therapy"
Comparison	None
Outcomes	("Reduced BMI" OR "BMI decrease" OR "Weight reduction" OR "Weight loss" OR "Body composition" OR "Fat loss" OR "Body weight" OR "Weight control" OR "Healthy weight" OR "Weight management")
Study design	“Cross-sectional” OR “Case-Control” OR “Cohort” OR “Randomised Controlled Trial” OR “RCT” OR “Cross-sectional Study” OR “Quasi-Experimental Studies”

Table 2: Inclusion & Exclusion Criteria

Elements	Inclusion	Exclusion
Population	Adolescents (10-18 years old) Obesity (BMI ≥35 kg/m²) English articles only Articles until 2025	Animal studies
Intervention	Meal replacement plans	Non-meal replacement dietary interventions
Comparison	None	
Outcomes	Weight reduction (total or percentage)	Not related to obesity reduction or weight management
Study design	Cross-sectional Studies Case-Cohort Studies Cohort Studies Randomized Controlled Trials (RCTs) Quasi-Experimental Studies	Opinion papers Review articles

The methodological quality of the included studies was assessed using the Quality Criteria Checklist for Primary Research (QCCPR) (Academy of Nutrition and Dietetics, n.d.). Each study was rated as positive (+), neutral (Ø), or negative (–) based on its validity and relevance.

Data were extracted for study design, participants, interventions, outcomes, follow-up, sustainability, side effects, and limitations. The findings were summarised in a tabular format, adapted from Schünemann et al. (2024).

This review was registered with PROSPERO (ID: CRD42025634588). Ethical approval was not required, as no human or animal participants were involved.

RESULTS

Figure 1 shows the PRISMA flow diagram, which identifies 197 studies and includes seven studies for final review. The seven studies (Fox et al., 2021; Fox et al., 2016; Gow et al., 2024; Gross et al., 2024; Lei et al., 2020; Phan et al., 2013; Xanthopoulos et al., 2013) met the inclusion criteria, with sample sizes ranging from 30 to 2,825 adolescents. Study designs included randomized controlled trials, cohort studies, and pilot interventions, conducted in diverse populations across multiple countries. Interventions primarily consisted of very-low-energy diets (VLED), total meal replacement plans, or partial replacement regimens combined with standard dietary advice. All included studies were appraised as having overall positive methodological quality, supporting their suitability for synthesis.

All studies met no fewer than two out of four relevance criteria and were overall quality assessed as positive (+). Validity scores varied between 6/10 and 10/10, and the highest quality studies were characterised by methodological rigour at the design, measurement, and reporting stages. Commonly unmet criteria included non-blindedness, inadequate reporting of sources of funding, and inadequate reporting on reasons for participant withdrawal. In general, the studies included have a good level of evidence in support of meal replacement therapy for adolescent obesity intervention, at least in the short term. Nevertheless, the variation in long-term efficacy and differences in methodology point to some needed improvements.

Across all studies, MRPs consistently produced short-term reductions in BMI or body weight. Reported decreases ranged between 3.4% and 6.3% over intervention periods of 4–12 weeks (Berkowitz et al., 2011; Khayutin et al., 2023). Adjunctive strategies, such as caregiver involvement, pharmacological support (e.g., exenatide), and financial incentives, further enhanced weight outcomes. However, the long-term sustainability of these reductions was mixed. Several trials reported partial or complete weight regain after 12 months; however, programs incorporating caregiver engagement or digital health monitoring demonstrated better maintenance of weight loss.

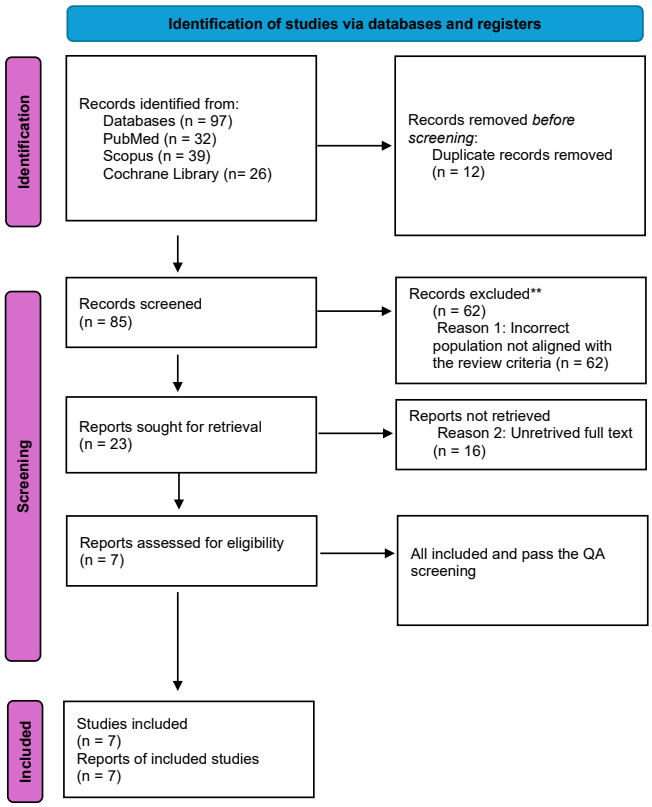

Figure 1: Results of study selection using PRISMA 2020 Flow Diagram (Page et al., 2021)

Safety outcomes were generally reassuring. Reported adverse effects were mild and transient, including hunger, fatigue, nausea, and gastrointestinal discomfort. No studies reported adverse effects on linear growth or pubertal development (Astbury et al., 2019; Evans et al., 2023). Poor adherence was identified as a common challenge, especially in more restrictive interventions such as total diet replacement. Although meal replacement interventions often result in short-term weight loss, evidence on their long-term sustainability remains inconsistent. While Lowe et al. (2018) demonstrated maintenance at 36 months with a home food environment intervention, other studies, such as Xanthopoulos et al. (2013) and Fox et al. (2021), reported significant weight regain within 12 months, particularly when pharmacological or behavioural support was lacking. These findings highlight a persistent gap in sustaining treatment effects, suggesting that current interventions may be insufficient without ongoing management. The variability across studies underscores the need for more rigorous long-term trials to identify effective strategies for maintaining weight loss beyond the initial intervention phase among adolescents.

DISCUSSION

This review evaluated the effectiveness, sustainability, and safety of meal replacement plans (MRPs) in managing obesity among adolescents. The findings demonstrated that MRPs consistently achieved short-term weight reduction within 4 to 12 weeks. These results align with previous adult studies, which also reported clinically significant short-term weight loss through MRPs (Astbury et al., 2019; Khayutin et al., 2023). The effectiveness in the short term can be explained by the substantial calorie restriction imposed by MRPs, which creates a rapid negative energy balance. Additionally, the structured nature of MRPs facilitates dietary decision-making and portion control, resulting in better compliance in the early stages. However, over time, physiological adaptations such as reduced metabolic rate and increased appetite-regulating hormone responses may occur, which can diminish their effectiveness for sustained weight loss. In adolescents, the incorporation of caregiver involvement, digital monitoring tools, and pharmacologic agents further enhanced treatment outcomes, underscoring the importance of multi-component approaches (Berkowitz et al., 2011; Bhagat et al., 2024).

Despite the promising short-term benefits, evidence for long-term sustainability was less consistent. Several studies reported weight regain after 12 months, reflecting the challenges of maintaining adherence once structured interventions ended (Berkowitz et al., 2011; Ferentinou et al., 2023). This echoes findings in adult populations where weight maintenance after MRPs remains a key limitation (Astbury et al., 2019). Adolescents face additional barriers, including psychosocial stressors, social media influence, and family dynamics, which may contribute to poor adherence or relapse (Nagata et al., 2023; Lister et al., 2023). The cost of MRP products may also present a barrier, particularly for families from lower socioeconomic backgrounds, as sustained use could be financially burdensome. This economic factor, combined with limited accessibility in certain communities, further reduces long-term adherence. Interventions with caregiver participation, ongoing behavioural support, and consideration of affordability demonstrated greater potential for sustained weight management (Lambert et al., 2024).

In terms of safety, MRPs were generally well tolerated in adolescents. Reported side effects were mild and transient, including hunger, fatigue, nausea, and gastrointestinal symptoms, with no evidence of adverse effects on growth or pubertal development (Evans et al., 2023; Lee, 2015). However, total diet replacement or highly restrictive regimens were associated with higher

dropout rates and adherence difficulties, suggesting that partial replacement strategies may be more feasible for this age group (Oussaada et al., 2019; Yamada et al., 2023). Current guidelines recommend that MRPs and very-low-energy diets should only be initiated in adolescents with severe obesity, typically defined as BMI ≥35 kg/m² or ≥120% of the 95th percentile, and under close medical supervision (CPG for the Management of Obesity, 2023; Kelly et al., 2013). Furthermore, calorie restriction in this population should generally not fall below 800–1200 kcal/day to prevent nutrient deficiencies, emphasising the importance of individualised planning and monitoring (Andela et al., 2019).

Strengths and Limitations of the Review

The strengths of this review include the use of a systematic methodology guided by PRISMA (Page et al., 2021) and quality appraisal tools (Academy of Nutrition and Dietetics, n.d.), ensuring that findings were synthesized from methodologically sound studies. However, limitations must be acknowledged. The number of eligible studies was small, sample sizes were often limited, and follow-up durations were generally short (Astbury et al., 2019; Berkowitz et al., 2011). Furthermore, heterogeneity in interventions and outcome reporting limited the ability to draw firm conclusions regarding long-term effectiveness (Smyczyńska et al., 2024).

Implications and Future Directions

Future research on MRPs for adolescents should focus on conducting well-designed, large-scale trials with extended follow-up to evaluate the long-term safety and effectiveness of these products. Studies should also address developmental considerations unique to adolescence, including nutritional adequacy for growth and psychological well-being in treatment. Additionally, exploring the cost-effective MRP strategies is necessary to ensure sustainability. Moreover, integrating digital health tools with social support platforms may also enhance adherence, engagement, and sustained behaviour change.

CONCLUSION

The use of MRPs has been demonstrated to be safe and effective in achieving short-term weight loss among adolescents with obesity, with no adverse effects on growth and development. Outcomes were further strengthened when caregivers were involved and when pharmacological or digital health support was integrated. However, the variability in long-term sustainability underscores the need for ongoing support strategies to sustain weight loss and ensure lasting health benefits.

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