SYSTEMATIC LITERATURE REVIEW OF DETERMINANTS OF OBESITY IN BREASTFEEDING MOTHERS

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ABSTRACT

Maternal obesity can potentially lead to weight gain and the risk of various disease problems. This article aims to provide a synthesis of research evaluating the determinants of maternal obesity. Medline/PubMed, Scopus and Springer databases were searched to find relevant articles. Two authors performed screening, data extraction and quality assessment independently. Objective To review the determinants of obesity in breastfeeding mothers with interventions of diet, physical activity, counseling and use of the Mhealth app among obese breastfeeding mothers. Methods Three databases were searched for randomized controlled trials (RCTs) published from 2019 to 2024 that reported weight change outcomes for diet, physical activity, combined diet and physical activity, counseling and use of the MHealth app. Overall, we found that diet and physical activity or exercise interventions were effective for postpartum women. Weight Loss The diet group showed significant weight loss of -2.3 kg at 3 months and -4.2 kg at 12 months, compared with the control group who gained weight over the same period. Fasting Blood Glucose Decrease There was a significant reduction in fasting blood glucose levels in the diet group after 12 months (P=0.007), suggesting improved insulin sensitivity and potential There was a significant reduction in fasting blood glucose levels in the diet group after 12 months (P=0.007), suggests improved insulin sensitivity and potential benefits to glucose metabolism. Waist Circumference Difference The dietary intervention group showed better reduction in waist circumference and weight retention than the control group, indicating that dietary intervention is effective in managing fat distribution and weight retention in obese postpartum women. Conclusion-Dietary intervention, physical activity, breastfeeding counseling, Mhealth application can reduce postpartum women weight retention.
Keywords: Systematic Review, Determinants, Obesity, Breastfeeding Mothers

ABSTRAK

Obesitas ibu yang telah melahirkan berpotensi menyebabkan kenaikan berat badan dan resiko terjadinya berbagai masalah penyakit. Artikel ini bertujuan memberikan sintesis penelitian yang mengevaluasi determinan obesitas terhadap ibu menyusi. Basis data Medline/PubMed, Scopus dan Springer ditelusuri untuk menemukan artikel yang relevan. Dua penulis melakukan penyaringan, ekstraksi data dan penilaian kualitas secara independen. Tujuan Untuk meninjau determinan obesitas pada ibu menyusui dengan intervensi diet, aktifitas fisik, konseling dan penggunaan aplikasi Mhealth dikalangan ibu menyusui yang mengalami obesitas. Metode Tiga basis data ditelusuri untuk studi terkontrol acak (RCT) yang diterbitkan tahun 2019 sampai tahun 2024 yang melaporkan hasil perubahan berat badan dari intervensi Diet, aktifitas fisik, kombinasi diet dan aktifitas fisik serta pemberian intervensi konseling dan penggunaan aplikasi MHealth Secara keseluruhan, kami menemukan bahwa intervensi diet dan aktifitas fisik atau olah raga efektif untuk ibu pascasalin Penurunan Berat Badan Kelompok diet menunjukkan penurunan berat badan yang signifikan sebesar -2,3 kg pada 3 bulan dan -4,2 kg pada 12 bulan, dibandingkan dengan kelompok kontrol yang mengalami kenaikan berat badan pada periode yang sama. Penurunan Glukosa Darah Puasa Terjadi penurunan signifikan pada kadar glukosa darah puasa di kelompok diet setelah 12 bulan (P=0,007), menunjukkan peningkatan sensitivitas insulin dan potensi manfaat bagi metabolisme glukosa. Perbedaan Lingkar Pinggang Kelompok intervensi diet menunjukkan penurunan lingkar pinggang dan retensi berat badan yang lebih baik dibandingkan kelompok kontrol, menandakan bahwa intervensi diet efektif dalam mengelola distribusi lemak dan

retensi berat badan pada wanita pascapersalinan dengan obesitas. Kesimpulan— Intervensi diet, aktifitas fisik, konseling menyusui, aplikasi Mhealth mampu menurunkan resintensi berat badan ibu pascasalin.

Keywords:Systematic Review, Determinants, Obesity, Breastfeeding Mothers

INTRODUCTION

The World Health Organization (WHO) defines overweight as a body mass index (BMI) greater than or equal to 25 kg/m2 and obesity as a BMI equal to or greater than 30 kg/m2. The number of women who are overweight or obese during pregnancy and lactation has increased sharply in recent decades, in line with rising global obesity rates (Leghi et al., 2020). Pregnancy and the postpartum period are critical life stages that can make women susceptible to obesity. Excessive gestational weight gain (GWG) is a predictor of postpartum weight retention (Liu et al., 2022). Excessive weight gain due to pregnancy and postpartum weight retention appear to contribute to the obesity epidemic among women. Obesity is a growing problem on a global scale among populations in both developing and developed countries. Pregnancy and the postpartum period are times when mothers are particularly vulnerable to weight gain and changes in body composition. Although many women desire to return to their prepregnancy weight after childbirth, very few achieve this goal. Excessive postpartum weight retention (PPWR) can lead to long-term maternal obesity and is associated with cardiovascular disease, hypertension, diabetes, and degenerative joint disease.(He et al., 2015). Women with high pre-pregnancy weight are at higher risk for postpartum weight retention and postpartum metabolic syndrome. BMI and body fat percentage increase with increasing parity, and postpartum weight retention increases BMI (Ohman et al., 2022). Therefore, the postpartum period is a critical period for interventions designed to prevent later onset of obesity and diabetes in vulnerable populations.(Klein, 2019). The aim of this systematic review is to synthesize research evaluating the impact of maternal obesity including BMI, interventions performed and maternal weight retention.

METHOD

Participant characteristics and research design

This review study focuses on research including overweight/or obese postpartum women who are breastfeeding, BMI 25-35 kg/m2 before pregnancy, do not smoke and have a birth weight of >2500 gr, weight retention with Randomized Control Trail (RCT) studies.

Search Strategy

The search was conducted in MEDLINE/PubMed, Scopus, Springer databases. The search terms, medical subject headings (MeSH), and truncation symbols (*) used for MEDLINE/PubMed were (postpartum AND postpartum OR Obesity OR intervention OR diet OR exercise OR weight retention. The search strategy was adapted to the subject headings and syntax of other electronic databases. The literature search was restricted to human studies, with a study year limit of 2019–2024 applied. Reference lists of included studies were scanned for potentially relevant articles.

Selection Process

The search results were initially uploaded to EndNote software and, after duplicates were removed, entered into a PRISMA table (Figure 1). The selection of articles for inclusion in the review was carried out in two stages. The first stage involved screening the titles and abstracts of the search results against the eligibility criteria. In the second stage, the full articles of the papers selected in the title/abstract screening stage were screened to ensure that they met the eligibility criteria. In both stages, each article was screened independently by two authors. Disagreements in eligibility status between the first two authors were resolved by mutual discussion.

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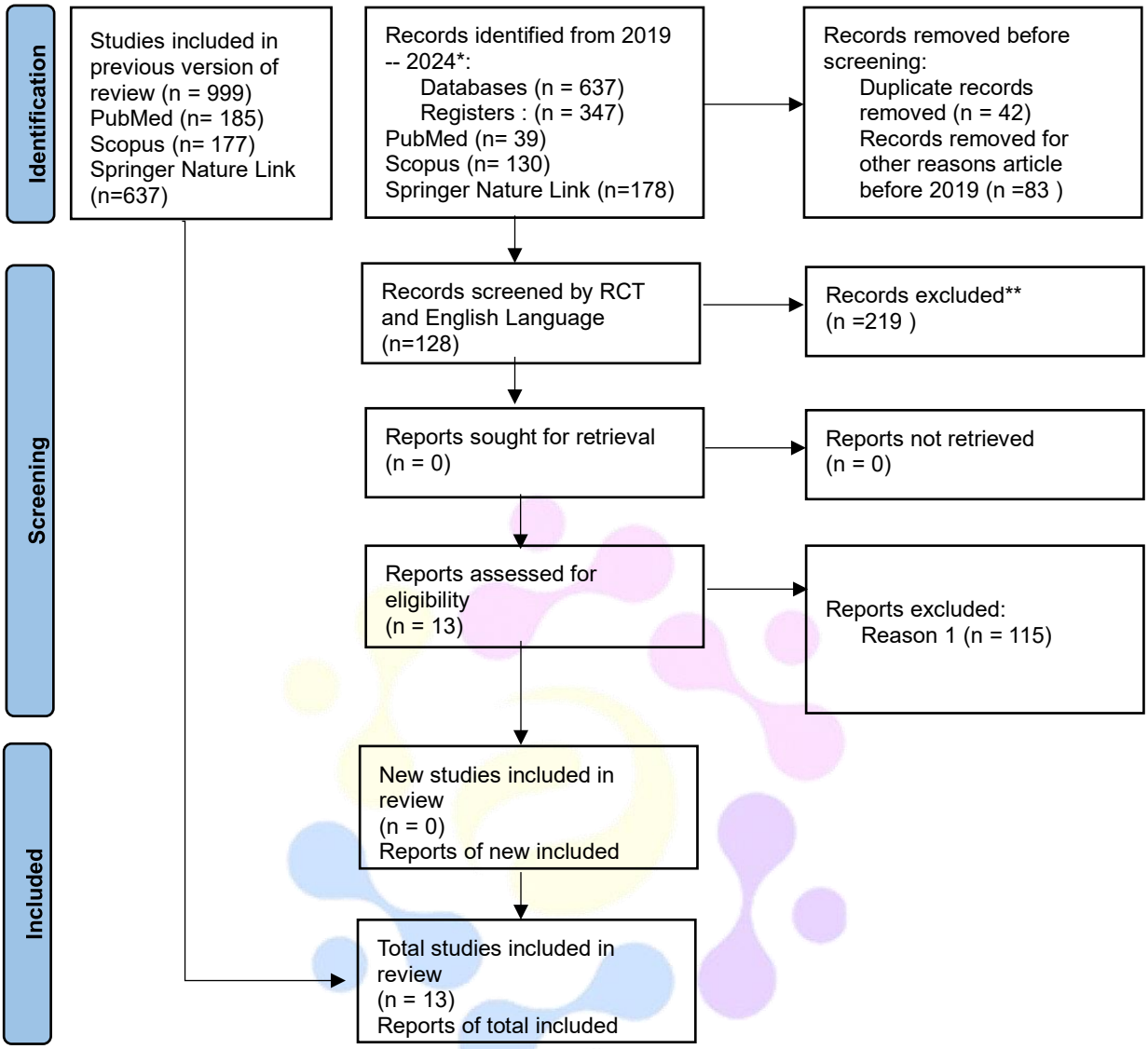

RESULTS AND DISCUSSION

Based on the screening that has been done with two validators, 13 articles were obtained that met the inclusion criteria that have been set according to the limitations of this research topic, namely the determinants of obesity in breastfeeding mothers using the RCT research design. Respondents in all articles reviewed in this study were breastfeeding or postpartum mothers, had a BMI of 25-35 or obesity category and underwent diet treatment, physical activity.

Table. Identification of Articles Reviewed in the Research

No	Writer	Title	Year	Research result
1.	Elisabeth, et al	Dietary treatment postpartum in women with obesity reduces weight and prevents	2023	that the LEVA (Lifestyle for Effective Weight Loss During Lactation) dietary intervention is effective in helping breastfeeding mothers with postpartum obesity to achieve weight loss and improve metabolic profiles.

No	Writer	Title	Year	Research result
		weight gain: a randomized controlled trial		
2	Elisabeth, et al	Effects of dietary and exercise treatments on HDL subclasses in lactating women with overweight and obesity: a randomised secondary analysis controlled trial	2022	Dietary treatment had a greater effect than exercise in increasing HDL subclasses and HDL size, which may be associated with improved metabolic fitness and reduced cardiovascular risk in postpartum women.
3	Yoshimi, et al	Short- and Long-term Effects of a Mobile Phone App in Conjunction With Brief In-Person Counseling on Physical Activity Among Physically Inactive Women The mPED Randomized Clinical Tria		Mobile phone apps are effective in increasing physical activity, but less effective in maintaining improvements without additional support.
4	Andrea, et al	A Postpartum Weight Loss-focused Stepped-care Intervention in a Military Population: A Randomized Controlled Trial	2023	Weight Retention: Those receiving the PPWL intervention, both in the PPWL alone and combination groups, showed an average weight retention reduction of 1.31 kg compared to the GWG alone group which experienced a weight retention of 2.39 kg. Nearly half of participants receiving the PPWL intervention achieved their pre-pregnancy weight at 6 months postpartum, although the statistical difference was not significant. This study suggests that this stepwise program is effective in reducing postpartum weight retention in the military population.

No	Writer	Title	Year	Research result
5	Fanny Aldana, et al	Effectiveness of a new approach for exclusive breastfeeding counseling on breastfeeding prevalence, infant growth velocity and postpartum weight loss in overweight or obese women: protocol for a randomized controlled trial	2019	that breastfeeding interventions will increase the prevalence of exclusive breastfeeding, slow infant growth rate, and reduce maternal postpartum weight gain over a period of up to four months
6	Elisabeth, et al	Effects of Breastfeeding Promotion Intervention and Dietary Treatment in Postpartum Women with Overweight and Obesity: Results from a Randomized Controlled Trial on Weight and Cardiometabolic Risk Factors	2024	No significant effects of BPI on weight loss or cardiometabolic risk factors were found at 6 months postpartum. The dietary intervention resulted in a significant weight loss of -3.4 kg and reductions in body fat, fasting glucose, and insulin. These effects suggest that dietary management is safe for lactating women without interfering with breastfeeding practices. There was no significant interaction between BPI and Diet in influencing the measurement results.
7.	Margriet, et al	The INTER-ACT E-Health Supported Lifestyle Intervention Improves Postpartum Food Intake and Eating Behavior, but Not Physical Activity and Sedentary Behavior—A Randomized Controlled Trial	2021	**individual dietary interventions based on the Health Belief Model (HBM)** had a positive effect on nutritional intake in postpartum mothers in Japan. At 6 months after delivery, women who received the intervention showed increased intakes of protein, dietary fiber, potassium, magnesium, phosphorus, iron, zinc, vitamin B6, and β-carotene compared with the control group. Although these improvements in diet quality were limited, the HBM-based dietary intervention was shown to be effective in improving postpartum maternal dietary patterns in a clinical setting
8	Femke, et al	The impact of self-monitoring physical and mental health via	2024	mHealth application-based intervention that allows self-monitoring of weight, steps, and mental health has the potential to

No	Writer	Title	Year	Research result
		an mHealth application on postpartum weight retention: Data from the INTER-ACT RCT		reduce postpartum weight retention (PPWR) in mothers with excessive weight gain during pregnancy. This study showed that the more frequently mothers recorded their weight through the app, the greater the weight loss and the lower the likelihood of significant weight retention (≥ 5 kg). In addition, mental health monitoring was also associated with a reduced likelihood of PPWR, although it did not have a direct impact on weight loss.
9	Margriet, et al	The INTER-ACT E-Health Supported Lifestyle Intervention Improves Postpartum Food Intake and Eating Behavior, but Not Physical Activity and Sedentary Behavior—A Randomized Controlled Trial	2021	INTER-ACT lifestyle intervention that supports eating behavior through e-health applications and face-to-face coaching sessions are effective in improving diet and eating behavior in postpartum mothers who experienced excessive weight gain during previous pregnancies. Results showed an increase in eating control and a decrease in energy intake, but no significant changes were found in physical activity or sedentary behavior. Despite improvements in nutrition, the benefits of this intervention could not be maintained in the long term, as the improvement effects declined after six months of follow-up.
10	Debra, et al	Randomized Controlled Trial of Home-based Lifestyle Therapy on Postpartum Weight in Underserved Women with Overweight/ Obesity	2019	A lifestyle-based intervention delivered through the Parents as Teachers (PAT) program with the addition of a PAT+Lifestyle component was effective in reducing postpartum weight gain in underserved, overweight or obese African-American women. The PAT+Lifestyle group demonstrated lower weight gain and were more likely to return to baseline weight within 12 months after delivery compared with the standard PAT program alone. However, no significant differences were found in cardiometabolic outcomes between the two groups.
11	Jihong Liu, et al	Effects of a lifestyle intervention on postpartum weight	2022	Lifestyle interventions initiated during pregnancy and continued postpartum have been shown to be effective in

No	Writer	Title	Year	Research result
		retention among women with elevated weight		reducing weight retention in overweight or obese women. These findings support the importance of a sustained approach to supporting postpartum weight loss and suggest that pregnancy is an appropriate time to initiate such interventions.
12	Julia Hoffmann, et al	Effects of a Lifestyle Intervention in Routine Care on Short- and Long-Term Maternal Weight Retention and Breastfeeding Behavior—12 onths Follow-up of the Cluster-Randomized GeliS Trial	2019	Lifestyle interventions can slightly reduce PPWR and increase the proportion of exclusive breastfeeding in routine antenatal care. However, the clinical effects of these interventions are considered limited. It is important to assess other factors, such as postpartum physical activity levels and dietary habits, and consider individual needs based on risk subgroups.
13	Madhuri, et al.	The Impact of a Lifestyle Intervention on Postpartum Weight Retention Among At-Risk Hispanic Women	2021	Culturally tailored lifestyle interventions for Hispanic women at risk for diabetes may increase the chances of achieving long-term postpartum weight loss goals, especially for those who are more physically active.

DISCUSSION

Determinants that influence breastfeeding mothers towards obesity are the main factors that can be divided into physiological categories, diet, physical activity, and psychological and social factors. Metabolic and Hormonal Changes: After giving birth, the mother's body undergoes significant hormonal changes, including changes in prolactin hormone levels (which support breast milk production). This condition can affect fat metabolism and storage, which plays a role in weight gain. lifestyle interventions that begin during pregnancy and continue postpartum on postpartum weight retention in overweight or obese women. The study found that the group receiving the intervention, which included theory-based dietary and physical activity counseling and social support, showed lower weight retention at 6 and 12 months after giving birth compared to the control group that only received standard care. This difference was statistically significant, with intervention participants retaining an average of 3.6 kg less at 6 months and 2.4 kg less at 12 months after giving birth compared to control participants (Liu et al., 2022). Calorie Intake and Diet: In breastfeeding mothers, calorie needs increase to support breast milk production, but an unbalanced diet can lead to excess calorie intake without considering nutritional value. Consumption of foods high in fat and sugar, and low in fiber and protein, can increase the risk of obesity. Dietary intervention to reduce postpartum weight retention in obese women. In this study, the LEVA method, an approach that focuses on reducing daily calories by 500 kcal with gradual adjustments to diet, was used as an intervention for the test group. This method was proven to be effective in reducing body weight, waist circumference, and postpartum weight retention (PPWR) at 3 months and 12 months postpartum. The results showed an average weight loss of 4.2 kg in the diet group after 12 months, while the control group experienced an

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average weight gain of 4.8 kg in the same period. In addition, this intervention had an effect on reducing fasting blood glucose at month 12, which can improve insulin sensitivity and reduce the risk of type 2 diabetes in high-risk groups. lifestyle intervention designed to reduce postpartum weight retention among women with abnormal glucose tolerance during pregnancy. Although some outcomes related to lipid and glucose metabolism did not show significant differences, the trend of improvement in the diet group suggests the potential to prevent future health complications in obese women. Implementation of this method is also recommended to be adapted with adjustments to weight loss targets to be effective in the long term (Øhman et al., 2023). In addition, the effectiveness of diet and exercise has a significant impact on reducing HDL levels and improving metabolic health and reducing the risk of cardiovascular disease (CVD) in breastfeeding women with obesity (Ohman et al., 2022). **Physical Activity**: Breastfeeding mothers often have limited time to exercise or move actively due to the responsibility of caring for their baby. This lack of physical activity can lead to weight gain and fat accumulation, especially if the diet is unbalanced. , to lose weight in postpartum mothers requires various supports, one of which is a technology-based application that can be effectively used to initiate changes in physical activity behavior, and the use of Ehealth has also been shown to reduce weight in postpartum mothers, but there are limitations in the sustainability of increased activity without additional support or modifications to the application to maintain longterm effects. This application is considered quite relevant to increasing physical activity and weight loss in a population that has time constraints, especially in women with various demands of responsibility (Fukuoka et al., 2019),(Pérez-Muñoz et al., 2023). Not only diet intervention and physical activity of a mother in labor need counseling and health education to maintain her weight and also lose weight, in addition, postpartum mothers need to continue to be motivated to always provide exclusive breastfeeding because in a study conducted by Aldana, et al positive influence on maternal and infant health, providing evidence that structured counseling and tailored to individual needs, especially for mothers with obesity, can increase the duration and quality of exclusive breastfeeding. Sleep Quality and Duration: Lack of sleep is often experienced by new mothers due to irregular baby sleep patterns. Lack of sleep can affect the hormones leptin and ghrelin which regulate hunger and satiety, thereby increasing appetite and the risk of obesity. Stress and Psychological Factors: Major changes in life and the pressure of being a new mother often trigger stress. This stress can trigger emotional eating behavior, which often involves consuming high-calorie foods. Social and Environmental Support: A supportive environment can help breastfeeding mothers maintain a healthy lifestyle. Conversely, poor support or non-conducive environmental conditions can make it difficult for mothers to maintain a healthy diet and activity. These factors interact in a complex way in determining the risk of obesity in breastfeeding mothers. Prevention and management of obesity during breastfeeding requires a comprehensive approach, including nutrition education, family support, and appropriate physical activity management. Not only dietary interventions and physical activity, a mother in labor requires counseling and health education to maintain her weight and lose weight, in addition, postpartum mothers need to continue to be motivated to always provide exclusive breastfeeding because in a study conducted by Aldana, et al., the positive effect on maternal and infant health, provides evidence that structured counseling and tailored to individual needs, especially for mothers with obesity, can increase the duration and quality of exclusive breastfeeding. In addition, this study also measured the effect of counseling on prolactin levels in maternal serum and nutritional content in breast milk, which are expected to support optimal infant growth and weight loss in mothers (Aldana-Parra et al., 2020),(Øhman et al., 2024). Additional support focused on breastfeeding education has not been effective in addressing the psychosocial and structural factors that influence postpartum maternal decisions. Therefore, a more comprehensive approach that considers barriers to breastfeeding in this population may be needed to improve breastfeeding practices among high-risk women because many breastfeeding mothers still cite the perception that formula is better, breastfeeding discomfort, and concerns about milk supply as reasons for not starting or stopping breastfeeding, despite

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the clear benefits of breastfeeding for both mother and baby health (Liu et al., 2022)
Other studies have suggested that diet and exercise as interventions for postpartum weight loss are not sufficient, bariatric surgery is also recognized as a very effective method for women with obesity, especially if non-surgical approaches are unsuccessful. Bariatric surgery recommendations include patients with high BMI or those with metabolic disease that is unresponsive to treatment. In the postpartum context, surgical intervention is usually recommended after two years to maximize weight loss and avoid negative impacts on the fetus if pregnancy occurs during a period of rapid weight loss (Dellapiana et al., 2024), in postpartum weight loss many factors influence including factors that play a role such as BMI before pregnancy, excess weight gain during pregnancy, and parity. These factors are significantly associated with PPWR, reinforcing the need for a personalized approach for highrisk groups to reduce the risk of obesity later in life (Hoffmann et al., 2019).

RESEARCH LIMITATIONS

In general, the combination of physical activity and dietary interventions has been shown to be more effective than single interventions. Physical activity alone in weight management. However, the effects of physical activity plus intervention
Diet and Mhealth interventions tend to have more significant benefits in weight loss. As this review included diet, physical activity and physical activity plus diet interventions as well as the use of the Mheath app it was possible to compare their effects on weight loss and find new insights for future studies. Stricter inclusion criteria could have restricted this review to interventions, which only targeted supervised physical activity, but in practice, knowledge about the effectiveness of physical activity plus diet interventions and apps is relevant and important

CONCLUSION AND SUGGESTIONS

A tremendous opportunity for long-term health effects exists during childbearing and childrearing and taking advantage of it can impact not only a woman but her offspring. Evidence suggests that diet, supervised physical activity plus a monitoring program using the Mhealt app are effective in managing maternal weight and HDL levels postpartum. However, recommendations to promote physical activity without prescription/personalized physical activity goals in a physical activity plus diet intervention were not effective enough to prevent weight gain or weight retention postpartum. These findings highlight an effective approach to managing healthy weight postpartum. Furthermore, this systematic review provides a gateway for further research on weight-related health behavior strategies for postpartum women. The conclusion is a formulation of the answer to the research objectives, not a summary of the research results.

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ETHICAL CONSIDERATIONS

This article does not use research ethics because it does not use human or animal objects as research samples.

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Conflict of Interest Statement
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