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Literature Review: How Wearable Device Intervene Overweight/Obese People Loss Weight?

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Abstract. Background: Overweight and obesity present a significant global health challenge, associated with increased chronic disease risk and healthcare burden. Wearable devices, capable of continuously monitoring health metrics like activity and heart rate, offer a promising strategy for weight management interventions in this population. Objective: This review aimed to systematically elucidate the specific technological pathways, particularly the key sensors and devices employed, through which wearable devices intervene to facilitate weight loss in overweight or obese individuals. Method: A systematic search was conducted across major databases (PubMed, Scopus, Embase, Web of Science) for literature published between July 2015 and July 2025. Included studies detailed wearable device technical specifications (sensors, principles, algorithms), involved overweight/obese participants (BMI ≥25 kg/m²), and reported objective weight loss outcomes linked to device functionality. Screening yielded 14 eligible studies for analysis. Result: Wearable interventions primarily utilized commercial health trackers (e.g., Fitbit) or dedicated wearable sensors to monitor parameters like steps and heart rate, often combined with behavioral support. These devices facilitated weight loss through continuous monitoring, feedback provision, and behavioral prompting, demonstrating efficacy in reducing BMI, body weight, and visceral fat. However, adherence challenges, influenced by factors like age and technical issues, were identified as significant barriers to effective device utilization. Conclusion: Wearable devices represent a feasible intervention for weight loss in obese populations, primarily functioning via monitoring and feedback using commercial trackers or sensors. While effective, establishing clear criteria for device adherence and further investigating their specific contribution to weight loss outcomes are crucial future needs. Current evidence warrants cautious interpretation due to methodological limitations in existing studies.

Keywords: wearable device, obesity, weight loss, interventions

1. Introduction

Overweight (BMI ≥ 25 kg/m²) and obesity (BMI ≥ 30 kg/m²) represent a major global public health challenge, affecting over 1.9 billion and 600 million individuals, respectively [1]. Although obesity itself is not universally defined as a distinct disease in medical terms, it is strongly associated with an increased incidence of various chronic conditions, such as heart disease and type 2 diabetes [2].

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Complications arising from obesity contribute significantly to mortality rates and impose a substantial healthcare burden. Consequently, effectively addressing overweight and obesity is a critical health priority for the 21st century.

Wearable technology has now matured, enabling the continuous monitoring and tracking of key user health metrics, including heart rate, physical activity levels (steps), dietary patterns, and sleep quality [2]. By persistently collecting this data, these devices can generate real-time health feedback for users, thereby motivating weight loss behaviors [3, 4]. This positions wearable devices as a feasible strategy for intervening in weight management among overweight or obese individuals.

While existing research has demonstrated the efficacy of wearables in supporting weight loss, there remains a relative paucity of systematic investigation into their specific intervention mechanisms—namely, which sensors and devices are utilized to facilitate weight reduction. Therefore, this study aims to elucidate the technological pathways through which wearable devices intervene in weight management for overweight/obese populations, with a specific focus on identifying the key sensors and devices employed.

2. Methods

2.1. Information sources

A literature search of the PubMed, Scopus, Embase, and Web Of Science (first 50 results) databases was conducted for all literature published through July 2015.The records retrieved from the databases were imported into a local systematic review management tool, Zotero.

2.2. Literature search

The literature search strategy included a combination of keywords and variations to identify articles that addressed (i)obesity, (ii) wearable technology, and (iii) weight loss. Keywords included "obesity", "wearable", "wearable device"; "weight loss", and "obese primary". The full search term strategy that was used for each database is outlined in Table 1.

According to Table 1, which presents the literature search strategies implemented in four major academic databases (PubMed, Scopus, Web of Science, and Embase) for this review, along with the corresponding initial search results.

Table 1: Literature search strategies and initial search results across databases

Database	Search strategy	Results
Pubmed	(("obeses"[All Fields] OR "obesity"[MeSH Terms] OR "obesity"[All Fields] OR "obese"[All Fields] OR "obesities"[All Fields] OR "obesity s"[All Fields] OR "obese primary"[All Fields]) AND "weight loss"[All Fields] AND ("wearability"[All Fields] OR "wearable"[All Fields] OR "wearables"[All Fields] OR "wearable device"[All Fields])) AND (clinical trial[Filter] OR randomized controlled trial[Filter] OR review[Filter] OR scoping review[Filter] OR systematic review[Filter])	44
Scopus	TITLE-ABS-KEY ((obesity OR "obese primary") AND ("weight loss") AND (wearable OR "wearable device")) AND (LIMIT-TO (DOCTYPE, "ar") OR LIMIT-TO (DOCTYPE, "re") OR LIMIT-TO (DOCTYPE, "cp"))	95
Web Of Science	("weight loss") AND (obesity) AND (wearable OR "wearable device") (All Fields) and Article or Review Article (Document Types) and 2025 or 2024 or 2023 or 2022 or 2020 or 2018 or 2017 or 2016 or 2019 or 2015 (Publication Years)	69
Embase	('obesity'/exp OR obesity OR 'obese primary') AND ('weight loss'/exp OR 'weight loss') AND (wearable OR 'wearable device'/exp OR 'wearable device') AND ([cochrane review]/lim OR [controlled clinical trial]/lim OR [systematic review]/lim OR [randomized controlled trial]/lim OR [meta-analysis]/lim) AND [2015-2025]/py	229

DOI: 10.54254/2755-2721/2025.LD38994

2.3. Inclusion and exclusion criteria

Review, article or conference papers were considered for inclusion in the review if they were published from July 2015 to July 2025 and were written in English. Furthermore, eligible papers needed to have described/reported on all of the following components within the contents of the paper:

1. Participant Inclusion Criteria: Participants must be individuals classified as overweight (BMI ≥25kg/m²), obese (BMI ≥30kg/m²), or patients with obesity-related comorbidities (e.g., diabetes, mental disorders, intestinal diseases). Individuals in the pre-obesity stage (transitioning from overweight to obesity) are also eligible for inclusion.

2. Wearable Device Technical Specifications: The wearable devices employed in the study must explicitly specify the methodologies used for physiological parameter detection (e.g., types of sensors utilized, their operating principles, data acquisition algorithms). Detailed descriptions of these technical aspects are required. Studies relying solely on telemedicine, mobile health (mHealth, e.g., smartphone applications) for parameter monitoring, or those failing to meet the aforementioned requirements for detailing wearable device technology, will be excluded. Study location, duration, and participant freedom are unrestricted.

3. Weight Loss Outcome Assessment Requirement: The study must incorporate at least one objective quantitative measure of weight loss efficacy (e.g., body fat percentage, Body Mass Index (BMI), visceral fat area, absolute body weight). Additionally, it must describe how the wearable device facilitates weight loss interventions through its functionalities (e.g., monitoring, feedback provision, behavioral prompting).

3. Results

3.1. Literature search result

The initial literature search yielded 437 records. Following de-duplication using Zotero reference management software, titles and abstracts were screened, resulting in the exclusion of duplicates. Subsequently, the remaining records were assessed against the pre-defined inclusion criteria, yielding 20 potentially eligible studies. Finally, a full-text review of these 20 studies was conducted to confirm their eligibility. After excluding studies that did not meet the inclusion criteria, 14 studies were deemed eligible and included in this review. Thus, the final sample for this review comprised 14 studies.

3.2. Review

Current research on wearable device interventions for weight loss in obese patients primarily falls into two categories:

The first category employs commercial health wearables (e.g., Fitbit) to monitor heart rate and step counts. Article 1 implemented a 12-week intervention (combining Fitbit monitoring with weekly dietitian-led behavioral therapy/caloric restriction, group strength training, and aerobic exercise prescriptions), revealing significantly greater weight reduction in the experimental group versus controls alongside higher patient satisfaction [1]. Article 5 similarly used Fitbit monitoring with behavioral intervention but extended the duration, showing no significant difference in weight loss efficacy compared to Article 1 [1, 5]. This outcome was attributed to the experimental group higher average daily physical activity, which may have diluted the device-specific effects. Article 6

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analyzed 100-day Fitbit data and found 33% of participants failed to meet valid wearing criteria (e.g., sustained wearing duration and data completeness), with age, BMI, and technical issues identified as primary contributing factors [6]. This finding was supported by Article 4, which utilized a multi-state model to analyze activity tracker data and confirmed that self-efficacy had no significant impact on physical activity status (active/inactive) [4].

The second category utilizes wearable sensors and activity trackers for monitoring. Article 7 adopted a prospective crossover trial design: participants alternated between wearable sensors (automated data collection) and manual recording every two weeks [7]. Results showed significant reductions in BMI and visceral fat in the sensor group. Article 8 extended the intervention period while integrating multidimensional exercise/dietary data, further validating the health benefits of wearable sensors [8]. Article 9 designed a 12-month multicenter randomized controlled trial comparing "standard dietary advice + device monitoring" versus advice alone (outcomes pending), aiming to provide evidence for device efficacy in weight loss [9]. Article 10 randomized controlled trial demonstrated that adding daily activity tracker alerts to nutritional counseling, supplements, and baseline device monitoring significantly increased daily steps and reduced sedentary time, with additional improvements in blood pressure control and fat mass reduction [10]. These findings support the hypothesis proposed in Article 9 [9].

Furthermore, studies using wearable fitness devices, activity monitors, and mobile health support devices collectively affirm the positive role of wearable technologies in weight management for obese patients, broadening the scope of device applications [3, 11, 12].

4. Discussion

4.1. Implication on research

Substantial evidence from existing research has demonstrated the efficacy of wearable devices in facilitating weight loss interventions for individuals with obesity. Monitoring patient metrics via commercial health wearables or wearable sensors, coupled with feedback provision, effectively motivates sustained weight loss efforts [10]. Future research should prioritize the following avenues:

1. In-depth investigation into the underlying mechanisms of wearable device-mediated weight loss interventions and the pursuit of technological innovations, such as novel sensor development and the refinement of artificial intelligence algorithms;
2. Rigorous validation of the effectiveness of wearable devices in weight loss interventions, establishing clear criteria for effective usage, with particular attention to addressing usage barriers to optimize data collection [6];
3. Exploration of the synergistic potential of wearable devices when integrated with complementary approaches (e.g., telemedicine, mobile health (mHealth)) to further substantiate their feasibility and application potential in weight management strategies.

4.2. Implication on clinical

Current research has demonstrated the feasibility of utilizing wearable devices for weight loss interventions in pediatric and geriatric obese populations [1, 8]. In clinical practice, wearable devices can assist these patient groups with weight management by providing physicians with feedback on key metrics (e.g., BMI, visceral fat area). This enables real-time monitoring of the weight loss process, facilitating the optimization or adjustment of weight loss strategies (such as intervention duration, exercise volume, medication regimen, etc.).

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Furthermore, studies have also validated the application of wearable devices for weight loss interventions in obese patients with comorbid conditions, such as diabetes or mental health disorders (including schizophrenia and depression) [11-13]. Clinically, when wearable devices are employed to intervene in the weight management of such comorbid patients, they can concurrently monitor disease-specific physiological indicators (e.g., HbA1c for diabetic patients). This assists physicians in managing the primary condition while simultaneously improving the patient's overall health status through weight reduction, thereby enhancing the effectiveness of treatment for the underlying disease. Moreover, the continuous collection of data on the association between obesity and these comorbidities provides a crucial foundation for the future development of targeted pharmacological agents and comprehensive treatment strategies specifically designed for patients with obesity and concurrent disorders.

5. Conclusion

5.1. Conclusion

Currently, wearable devices primarily intervene in weight loss for obese patients through technologies such as commercial health wearables (e.g., Fitbit) and wearable sensors. These devices function by continuously monitoring key patient indicators (such as heart rate and step count) and incorporating reminder and feedback mechanisms, aiming to enhance patient motivation for weight loss and thereby achieve intervention goals. Previous reviews have also demonstrated that research-grade health wearables (e.g., accelerometers and pedometers) can similarly produce significant intervention effects on weight loss in obese patients [2]. However, regarding the effective wearing criteria for these wearables (e.g., wearing duration, adherence requirements) and the extent of their contribution to weight loss interventions, sufficient research evidence is currently lacking. Therefore, further in-depth investigation is urgently needed to establish clear and effective wearing criteria.

5.2. Limitation

The existing research exhibits certain methodological limitations, necessitating a critical interpretation of the efficacy of wearable devices for weight loss intervention in obese patients. Specifically: studies focusing on elderly populations sometimes suffer from inadequate sample representativeness, such as gender imbalance (e.g., a predominance of female participants) and insufficient sample sizes, potentially compromising the validity of their population-level analyses [1]. When defining criteria for effective wearable device usage, some studies relied solely on qualitative interviews conducted at a single location (e.g., a New York City research site), limiting the generalisability of their qualitative findings [6]. The duration of intervention in certain studies was relatively short, rendering them primarily feasibility explorations rather than sufficient for establishing systematic conclusions. Furthermore, some devices used in the research have been discontinued, raising questions about their ongoing effectiveness. Collectively, these studies exhibit methodological shortcomings concerning sample size determination, control of study conditions, and sampling methodology. Consequently, the evidence regarding wearable devices as an intervention for weight loss in obese patients requires careful theoretical interpretation from a critical perspective.

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5.3. Future research

Current research has preliminarily established the feasibility of wearable devices for weight loss intervention in pediatric and elderly obese populations. However, studies targeting other age groups (e.g., adults), different genders (male and female), and specific populations (e.g., pregnant women) remain insufficient, with a lack of conclusive evidence regarding the feasibility of such interventions. Future research should prioritize exploring these demographic groups.

Regarding comorbid obesity with other conditions (e.g., diabetes, severe mental illness), existing findings indicate that: wearable devices can support weight loss in diabetic patients but show no significant improvement in their diabetic condition; portable technologies (e.g., AiperMotion 500) can effectively intervene in weight loss for patients with both diabetes and obesity [11, 12]. Future studies should further validate the potential of wearable devices to improve diabetes outcomes and rigorously evaluate the feasibility of portable technology interventions for weight loss in diabetic patients through randomized controlled trials (RCTs).

Research on weight loss in patients with severe mental illness demonstrates that wearable devices represent a feasible strategy to support weight reduction in this group, with step count correlating with weight loss outcomes [13]. Future investigations could explore different types of wearable devices to verify the generalizability of the step count-weight loss association in this population and examine whether such devices can contribute to improving the severe mental illness itself.

5.4. Potential application

Existing studies have demonstrated that combining wearable devices with mobile health (mHealth) technologies can enhance weight loss interventions for obese patients [9]. However, research integrating wearable devices with telehealth technologies (incorporating web-based platforms) to investigate their impact on long-term weight loss within lifestyle interventions has yielded results that did not meet expectations, showing no significant superiority over conventional behavioral weight loss methods [14]. Despite this, the field retains substantial research potential. Future research could focus on developing novel systems or artificial intelligence (AI) algorithms that integrate wearable devices with telehealth or mHealth technologies. Concurrently, leveraging the automated data collection capabilities of wearable devices can establish a robust data foundation for the deeper application of AI tools in clinical nutrition practice [7].

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