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Potential role of hybrid weight management intervention: A scoping review

Khang Jin Cheah[1], Zahara Abdul Manaf[1], Arimi Fitri Mat Ludin[2] and Nurul Huda Razalli[1]

Abstract

Background: Digital health has been widely used in delivering healthcare, presenting emerging opportunities to overcome barriers to effective obesity care. One strategy suggested for addressing obesity involves a hybrid weight management intervention that incorporates digital health. This scoping review aimed to map existing evidence regarding hybrid weight management intervention.

Methods: PubMed, Scopus, Cochrane Library, and the Web of Science electronic databases were searched for studies published between January 1, 2012 and May 16, 2023, with language restricted to English. The focus was on controlled trials in which a hybrid weight management intervention was used in the intervention among overweight or obese adults. The scoping review framework followed Arksey and O'Malley's guidelines and the Preferred Reporting Items for Systematic Reviews and Meta-Analysis Protocols (PRISM-P).

Results: Full-text article review in the screening stage resulted in a total of 10 articles being included for narrative synthesis. Almost two-third of the articles originated from the United States (60%), followed by Europe and Australia, each accounting for 20%. The most common hybrid weight management intervention type was the combination of face-to-face and telehealth (i.e. phone call/text messaging) (40%), closely followed by a combination email intervention (30%) and mHealth apps intervention (30%). Most of the face-to-face dietary interventions were delivered as a group counseling (80%), while some were conducted as individual counseling (20%). Most studies observed a positive effect of the hybrid weight management intervention on body weight (weight lost 3.9–8.2 kg), body mass index (decreased 0.58 kg/m^2), waist circumference (decreased 2.25 cm), and physical activity level compared to standard care. Findings suggest a direct association between hybrid weight management interventions and weight loss. The weight loss ranged from 3.9 to 8.2 kg, with some evidence indicating a significant weight loss of 5% from baseline. There is a need to explore stakeholders' telehealth perspective to optimize the delivery of hybrid weight management interventions, thereby maximizing greatest benefits for weight management.

Keywords

Obesity, weight management, digital health, telenutrition, blended intervention, hybrid intervention

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Introduction

The escalating prevalence of obesity has presented significant health challenges, given its significant contribution to both morbidity and mortality.[1] Globally, it was estimated that 39% of adults are overweight, while 13% are living with obesity.[2] In Malaysia, the prevalence of overweight and obesity increased steadily among adults between 2011 and 2019, increasing from 29.4% to 30.4% for overweight,

[1]Dietetic Program, Center for Healthy Ageing and Wellness (H-Care), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia
[2]Biomedical Science Program and Center for Healthy Ageing and Wellness (H-Care), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Kuala Lumpur, Malaysia

Corresponding author:
Zahara Abdul Manaf, Dietetic Program, Center for Healthy Ageing and Wellness (H-Care), Faculty of Health Sciences, Universiti Kebangsaan Malaysia, Jalan Raja Muda Abdul Aziz, 50300 Kuala Lumpur, Malaysia.
Email:zaharamanaf@ukm.edu.my

and from 15.1% to 19.7% for obesity.[3] The consequences of obesity extend beyond individual health, directly increasing medical expenditures:[4] furthermore, they cause economic impacts across countries, regardless of their economic or geographical context.[5]

In tandem with the rise in obesity, advancements in information and communication technology have significantly influenced the transformation of healthcare service delivery. The field of digital health has garnered considerable attention in addressing the escalating demands of healthcare systems, particularly in response to the impacts of the COVID-19 pandemic.[6] Digital health or eHealth is defined by WHO[7] as "the use of information and communications technology in support of health and health-related fields." It has been widely used in different interventions, especially during the recent COVID-19 pandemic. For example, the United States has witnessed a notable rapid and continuous increase in the utilization of telehealth, which began as a response to the COVID-19 pandemic.[8] Many federal governments have relaxed regulations on telemedicine, allowing healthcare providers to offer remote consultations and treatment to patients.[9] Even in the aftermath of the COVID-19 pandemic, numerous government agencies have persisted in delivering healthcare services through digital health platforms.[9,10] Hence, comprehensive interventions that incorporate digital health hold significant potential for integration into healthcare service delivery for weight management.[11,12]

Digital health surpasses the limitations of traditional face-to-face interventions, offering unparalleled advantages such as increased accessibility, convenience, patient engagement/adherence, healthcare cost-effectiveness, and resilience during crises.[13–16] From the patients' perspective, digital health interventions offer several advantages, including the ability to substitute in-person appointments, reduced waiting times, ease of using telecommunication tools, and positive peer experiences.[17] These factors contribute to patients' willingness to use digital health to access healthcare services. The transformative impact on the healthcare landscape is undeniable, and its role is expected to be increasingly utilized in the future to inform chronic disease management. This is particularly in response to an ageing population with increased life expectancy and a greater population health burden from overweight or obesity.[10,15]

Considering the escalating global prevalence of obesity,[2] digital health interventions, with their associated benefits, have gained popularity as effective tools for weight management.[18] Examples of digital health implementation in weight management include web-based interventions,[19] phone call-text messaging intervention[20] as well as the utilization of mHealth applications.[21] However, when compared to face-to-face interventions, digital health interventions may have certain disadvantages. Some drawbacks of telehealth include limitations in conducting comprehensive physical examinations, the potential of encountering technical difficulties,[22,23] the potential lack of adherence to the intervention program by patients,[19] and difficulties in establishing new relationships between healthcare providers and patients.[24]

To address the issue, a new comprehensive approach called hybrid weight management intervention, which combines both face-to-face and digital health intervention components could serve as the foundation for effective weight management. A study reported that providing extended care via digital health among adults with obesity can enhance significant long-term weight loss and the maintenance of lost weight.[25] Additionally, researchers have highlighted that multicomponent weight loss interventions, which include face-to-face consultations and subsequent follow-ups through telehealth platforms lead to greater weight loss outcomes.[21] By appropriately allocating resources within an integrated healthcare system, patients have revealed their preferences for access to both telehealth and in-person services.[26] It has become evident that a hybrid intervention is essential even beyond the COVID-19 pandemic.[26,27]

Nonetheless, there is a limited number of robust studies understanding the efficacy of hybrid weight management interventions in weight management, and their effectiveness may hinge on the specific design of the hybrid weight management intervention. Previous systematic reviews conducted in this field were fragmented,[27] as their focus was not solely on hybrid weight management interventions. The latest review conducted by Yang et al.,[28] revealed that blended or hybrid weight management interventions resulted in positive weight loss. However, their review paper included normal-weight participants and gestational patients who showed a high degree of heterogeneity in terms of BMI and disease populations. In contrast, our scoping review focuses specifically on the overweight and obese population, aiming to examine the evidence regarding the effectiveness of hybrid weight management interventions compared to standard care in promoting weight loss within this distinct group. Concurrently, the review also aimed to identify any limitations present in the current body of research on hybrid weight management intervention approaches.

Methods

This scoping review was conducted based on the protocols outlined by Arksey and O'Malley[29] and Levac et al..[30] The protocol for this scoping review adhered to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses for scoping reviews.[31] A standard approach was applied to map the literature landscape related to the selected topic, utilizing the following process: (i) formulating the review questions; (ii) identifying relevant studies; (iii) study selection; (iv) data extraction; and (iv) summarization of results.

Eligibility criteria

The review questions were formulated using the Population-Concept-Context approach. Our scoping review was motivated by the following research questions:

1. What characteristics define the published studies on hybrid weight management intervention?
2. What weight management outcomes are associated with the hybrid weight management intervention?
3. What limitations currently exist, and in what direction should future studies be oriented regarding hybrid weight management intervention?

A full description of the eligibility criteria is shown in Table 1 below.

Search strategy

A structured search strategy was applied to the electronic databases of PubMed, Web of Science, Scopus, and Cochrane Library to identify studies published between January 1, 2012 and May 16, 2023. The search terms used can be found in Table 2. Google Scholar was used to locate gray literature, involving a scan of the first 20 pages in the search results, as per the recommended protocol for topic searches.[32] Three additional articles were included during the backward citation tracking, as these interventions met the inclusion criteria.

Selection process

After completing the searches and eliminating duplicate studies, the studies records were downloaded into EndNote v.20 (2022 Clarivate) and imported onto Rayyan, a free online web-based title and abstract screening tool.[33] All titles, abstracts, and subsequently full texts were screened for eligibility by the primary investigator (KJC) and verified by a second co-investigator (AFML). Any disagreements on study selection were resolved by consensus or after discussion with the second author (ZAM).

Data charting and extraction

Once all eligible full-text publications were identified, the primary investigator (KJC) formulated the data charting and extraction process, which was further improved and verified by the other authors (ZAM, AFML, and NHR) to identify and organize evidence of hybrid weight management intervention. The data extraction included the authors' names, year of publication, study characteristics (i.e. study design, data collection period, and sample size), type of hybrid weight management intervention, and obesity-related outcomes, which include changes in weight, waist circumference, body mass index (BMI), and physical activity level).

Collating, summarizing, and reporting the results

Tables were created to present the extracted data, illustrating the overarching attributes of each study that met the inclusion criteria. Results were organized by using the type of hybrid weight management intervention in relation to outcomes connected to weight management.

Results

A flow diagram of the search results is shown in Figure 1. A total of 6504 records were retrieved from the database search, with 918 duplicates and 5487 articles excluded after title/

Table 1. Eligibility criteria of the scoping review.

Category	Inclusion criteria	Exclusion criteria
Study type	Articles published in peer-reviewed journals	Conference abstracts, report documentation (e.g. organizational reports, government documents), study protocol
Population	Both male and female adults (18 years old or older) with overweight or obesity	Conditions that may not be generalizable to the general population (e.g. chronic kidney disease, cancer, eating disorder) Animal, cell culture, or in vitro studies
Setting	Outpatient or community settings	Inpatients
Sample size	No limits	No limits
Study design	Intervention studies	Observational studies, narrative reviews, commentary, editorials, letters to the editor, case studies or reports
Year range	January 1, 2012 to May 1, 2023	Articles published before 2022 or after the search on May 1, 2023
Language	English	Non-English
Type of Intervention	Hybrid weight management intervention	Focused only on mHealth, web-based digital health/ telenutrition intervention and outcomes not related to weight management

Table 2. The search strategy of the scoping review.

# of search	Key terms
#1	"Chronic disease" OR "diabetes mellitus" OR "hypertension" OR "heart disease" OR hyperlipidemia* OR dyslipidemia*
#2	Overweight OR obese or obesity OR morbid obesity OR High BMI OR high body mass OR high body weight OR Weight loss
#3	Telenutrition OR telemedicine OR telehealth OR mHealth OR e-health
#4	Nutrition intervention OR face-to-face OR traditional consultations OR nutrition management OR in-person OR clinic-based
#5	#1 OR #2 OR #3 OR #4
#6	Hybrid OR Blended OR Hybrid weight management intervention OR Mixed intervention OR mixed face-to-face OR mixed web-based OR Mixed telemedicine OR Blended weight loss OR mixed telehealth
#7	#5 AND #6
Search limits	English language, adults > 18 years old

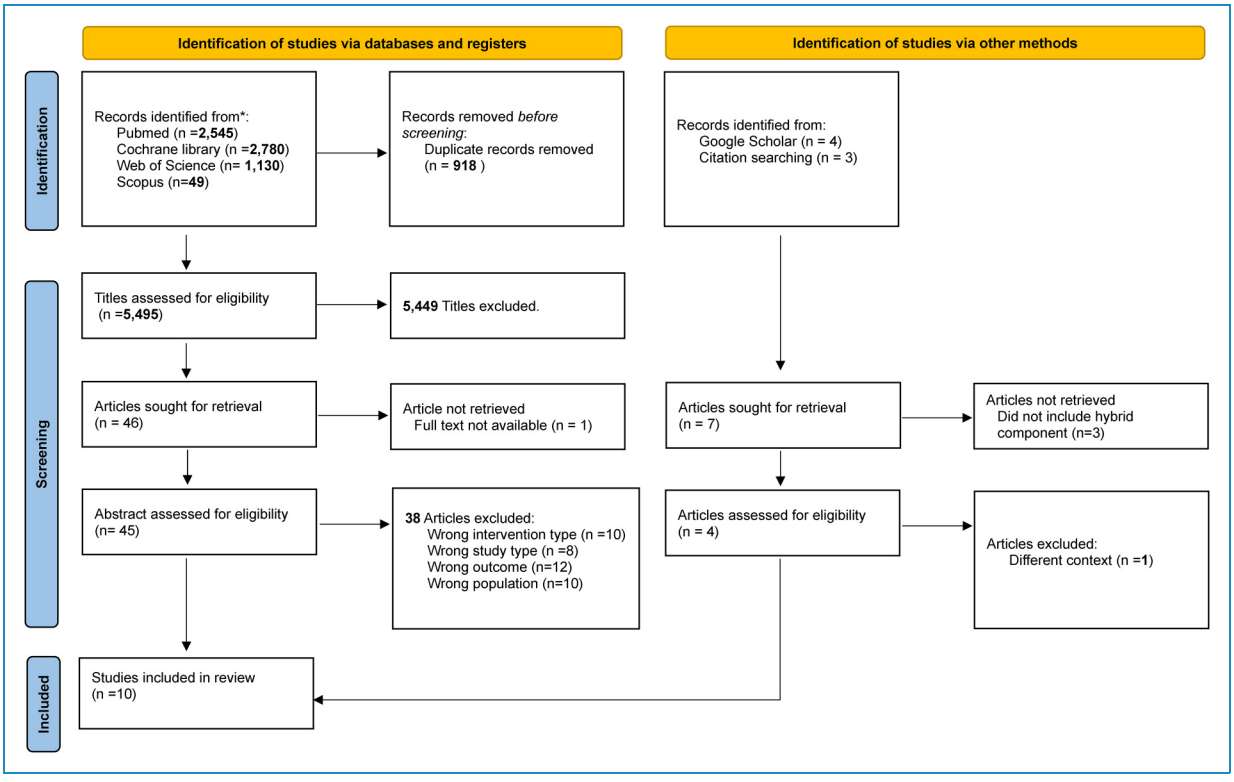

Figure 1. PRISMA 2020 flow diagram of the study selection process.

abstract screening. An additional six articles were added from manual searches. Following a thorough screening process based on predefined inclusion and exclusion criteria, we carefully assessed each study's relevance to the objectives of our review. As a result, we included only 10 studies that met the predetermined specific criteria for our scoping review.

Study characteristics

The study characteristics of all the 10 papers are summarized in Table 3. The studies were primarily based in the United States (6/10), followed by Europe (2/10), and Australia (2/10). Notably, no studies were from Asian

Table 3. Characteristics of the included studies (n = 10).

Author and year published	Aim	Country	Setting	Study design, duration	Methodology (study population, sample size, age)
Spring et al., 2013[33]	To test whether a connective mobile technology system, telephone coaching, and the standard obesity treatment improved weight loss outcomes compared with the usual care group	US	Primary care	2-arm, RCT, 12-month study **Control**: Usual care **Intervention (Int)**: Hybrid	Overweight and obese adults Total (N = 70); Control (n = 35), Intervention, Int (n = 35), Mean age: Total:57.7 ± 11.9 years old (y/o) Control: 57.7 ± 10.2 y/o Int: 57.7 ± 13.5 y/o
Adams et al., 2013[34]	To examine the effects of combined face-to-face and online interventions on sedentary behavior (SB) among overweight and obese women	US	Community	Two-group quasi-experimental study, 6 weeks **Control**: Usual care **Int**: Hybrid	Overweight adults Total (N = 64); Control (n = 24), Int (n = 40), Mean age: Control: 61.4 ± 12.1 y/o Int: 56.7 ± 12.6 y/o
Almeida et al., 2015[35]	To determine the effectiveness of an individually targeted Internet-based intervention with less intensive intervention	US	Working place	RCT, 6 months **Int 1**: Internet-based **Int 2**: Hybrid	Overweight adults Total (N = 28); Int 1 (n = 14), Int 2(n = 14), Mean age: Total: 46.96 ± 3.26 y/o Int 1: 45.68 ± 3.30 y/o Int: 48.24 ± 2.78 y/o
Crane et al., 2015[36]	To test the efficacy of a weight loss intervention designed to appeal to men	US	Community and workplace	RCT (2-arm), 6 months **Control**: Waitlist **Int 2**: Hybrid	Overweight or obese adults Total (N = 107); Control (n = 54), Int (n = 53) Mean age: Control: 43.7 ± 11.6 y/o Int: 44.7 ± 11.3 y/o

(continued)

Table 3. Continued.

Author and year published	Aim	Country	Setting	Study design, duration	Methodology (study population, sample size, age)
Hurkmans et al., 2018[37]	To compare the effectiveness of hybrid weight loss programs and mobile programs among adults who were overweight	Europe	Community	4-arm RCT, 3 months **Control**: Wait-list **Usual care**: Face-to-face **Int 1**: Mobile app **Int 2**: Hybrid	Obese adults Total (N = 102); Control (n = 18), Usual (n = 21) Int 1 (n = 24), Int 2 (n = 18) Mean age: Control: 45 ± 10.2 y/o Usual: 46 ± 9.2 y/o Int 1: 44 ± 12.4 y/o Int 2: 45 ± 9.6 y/o
Kouwenhoven-Pasmooij et al., 2018[38]	To evaluate the effects of a blended health promotion intervention among employees with high cardiovascular risk	Europe	Working place	Cluster-RCT, 12 months **Control**: Limited intervention **Int**: Hybrid (extensive intervention	Obese adults with high cardiovascular risk Total (N = 491); Control (n = 217), Int (n = 274) Mean age: Control: 51.6 ± 6.0 y/o Int 1: 50.2 ± 5.6 y/o Int 2: 53.4 ± 17.0 y/o
Lewis et al., 2019[39]	To investigate the efficacy of hybrid intervention on community-based obesity intervention	Australia	Community	RCT cross-over (2-arm), 4 months **Control**: Usual care **Int**: Virtual model	Obese adults Total (N = 61); Control (n = 32), Int (n = 29) Mean age: Control: 50 ± 31–74y/o Int 1: 49 ± 25–72 y/o
Duncan et al., 2020[40]	To investigate multicomponents eHealth interventions	Australia	Community	RCT (3-arm); 12 months **Control**: Wait-list	Overweight or obese adults Total (N = 116); Control (n = 36), Int 1 (n = 41); Int 2 (n = 39)

(continued)

Table 3. Continued.

Author and year published	Aim	Country	Setting	Study design, duration	Methodology (study population, sample size, age)
				Int 1: Traditional hybrid care **Int 2**: Enhanced hybrid care	Mean age: Control: 40.5 ± 10.7 y/o Int 1: 45.4 ± 10.2 y/o Int 2: 47.2 ± 9.4 y/o
Dhaver et al., 2022[41]	To test the clinical outcomes of the hybrid model for adults with obesity and diabetes	US	Primary care	Open labeled, 3 months **Control**: face-to-face **Int 1**: Virtual model **Int 2**: Hybrid model	Obese adults with diabetes Total (N = 56); Control (n = 22), Int 1 (n = 16) Int 2 (n = 18), Int 2 (n = 18) Mean age: Total: 56 ± 12.7 y/o Control: 56.3 ± 10.9 y/o Int 1: 58.2 ± 8.9 y/o Int 2: 53.4 ± 17.0 y/o
Almeida et al., 2023[42]	To evaluate the effectiveness of two technology-enhanced interventions for the prevention of diabetes among adults	US	Primary care	RCT (3-arm), 18 months **Int 1**: Standard care (Class) **Int 2**: Hybrid (Class + IVR) **Int 3**: Online (IVR + DVD)	Overweight adults Total (N = 334); Int 1 (n = 117), Int 2 (n = 110), Int 3 (n = 107) Mean age: Total: 52.3 ± 12.1 y/o Int 1: 54.2 ± 12.1 y/o Int 2: 51.4 ± 11.8 y/o Int 3: 51.2 ± 12.1 y/o

RCT = Randomized controlled trial; Int = Intervention; y/o = Y ears old; IVR= interactive voice response system; DVD= Digital versatile disc.

countries. Studies focusing exclusively on overweight or obese adults represent 80% of the literature. The remaining two research studies examined overweight/obese adults with diabetes (1/10) and high risk of cardiovascular disease (1/10). Of the 10 included articles, there were 3 studies conducted in primary care settings, 2 studies were conducted in workplace environments, and 4 in community-based settings. Only one article focused on both community and workplace settings. On the other hand, out of the 10 studies, 8 were randomized controlled trials (RCTs), while 1 study utilized a quasi-experimental design, and another utilized an open-label intervention approach.

Outcomes and study approaches

Supplemental Table S1 provides an overview of the methodology and findings for each article included in this review. All the studies focused mainly on anthropometry outcomes (e.g. weight, waist circumference, and BMI), with approximately 6 out of 10 studies' interventions focusing on physical activity behavior, and a smaller proportion (3/10) incorporating dietary intake behavior as their outcome measurement. The length of the intervention in the included studies ranged from 6 weeks to 12 months, with a majority of the studies assessing the outcomes at 2 different time points. The frequency and length of the intervention sessions varied widely among the studies. Not all studies provided the same sequence and frequency of face-to-face nutrition intervention sessions in their hybrid weight management intervention. For instance, Adam et al.[34] initially incorporated two face-to-face sessions in their hybrid weight management intervention before integrating digital health methods. On the other hand, Kouwenhoven-Pasmooij et al.,[35] conducted three face-to-face coaching sessions at intervals throughout their hybrid weight management intervention period.

With regard to professional involvement in the intervention, 6 of the 10 studies enlisted the expertise of dietitians for weight management. One study mentioned the involvement of registered nurses yet provided limited specifics regarding the other professional contributions,[34] while the intervention of another study was administered by occupational health physicians.[35] Two studies did not mention the involvement of healthcare professionals.[34,36] The intervention contents among the studies are quite similar, including elements related to dietary recommendations and physical activity,[34–43] albeit with differences in whether they incorporated personalized feedback or not. The majority of the studies did not report using any behavior change theories in the development of the intervention. The most utilized theoretical framework was the Social Cognitive Theory,[34,36,38,41] with one article reporting the use of the Cognitive-Behavioural Therapy.[42]

Overall, the studies are similar as they focused on hybrid weight management strategies, combining face-to-face sessions with digital health methods. In addition, their intervention content is almost similar, covering typical topics for weight loss management. Despite differences in frequency, professional involvement and certain intervention approaches, the interventions generally had positive effects on anthropometric outcomes such as weight, waist circumference, and BMI.

In most studies, face-to-face dietary interventions were provided in the intervals of digital health interventions (either in individual or group form) with a minimum total of two face-to-face sessions throughout the entire intervention period. The frequency gap between sessions ranges from 1.5 to 3 months. It is noteworthy that the initial session of hybrid weight management interventions always begins with a face-to-face approach.

Hybrid weight management interventions mode identification

The control group or standard care in the included articles can be categorized into three major categories: face-to-face individual sessions, face-to-face group education classes/sessions and no intervention (i.e. waiting list). The included articles reported three distinct modes of delivering hybrid weight management interventions: (1) face-to-face group or personal sessions combined with telehealth; (2) face-to-face group or personal session paired with a mobile application (mHealth); (3) group sessions along with email messages/newsletters. The hybrid weight management interventions were conducted either sequentially (i.e. face-to-face first, then telehealth)[34,41,43] or in an integrated manner (i.e. having face-to-face sessions between the telehealth intervention period).[35–40,42]

In general, the most common type of hybrid weight management intervention involved combining face-to-face and telehealth methods, such as phone calls, text messaging or virtual video calls (observed in 5 out of 10 studies). Specifically, Dhaver et al.[42] incorporated virtual video visits and face-to-face sessions during the intervention period, whereas the remaining studies employed either phone call visits or text messaging in their hybrid interventions.[35,37,40,43] This was closely followed by three studies incorporating a combination of email interventions,[34,36,38] and three studies that integrated mHealth apps into their interventions.[39,41,42] For the face-to-face interventions, most of them were delivered in a group format (7 out of 10 studies),[34,36–38,40,42,43] while 3 studies involved individual counseling.[35,39,41]

Effects of different hybrid weight management interventions on weight management

Of the 10 studies, 9 studies reported improvements in anthropometry outcomes from baseline to postintervention for both

control and intervention groups,[36,37,39,42,43] except one study which showed no improvement in weight within the control group.[35] Notably, 85.7% of the studies indicated that hybrid weight management intervention groups experienced significantly greater weight loss or reductions in waist circumference compared to the other group with participants losing between 3.9 and 8.2 kg ($p < 0.05$),[35,37,39,42] as well as experiencing a reduction of 2.25 cm in waist circumference ($p < 0.05$).[34] Another study demonstrated that, throughout the intervention period, the hybrid weight management intervention group experienced a reduction in BMI of 0.58 kg/m^2 ($p < 0.01$).[43] Most of the studies showed no substantial difference in weight changes between the intervention and control groups.

For physical activity (PA) level outcome, of those six studies with PA measurement, five showed improvements in physical activity level for both control and intervention groups without any significant difference found between the groups.[34–36,38,40] Conversely, one study showed no changes in PA level.[39]

Dietary intake component was the least focused outcome by the included studies. One study, which utilized a food screener to assess participants' dietary intake, demonstrated that both study groups exhibited improvements in fruit and vegetable intake, as well as reductions in fat intake.[36] Another study demonstrated a reduction in total energy intake only within the hybrid weight management intervention groups, while no significant changes were observed in the control group, as assessed using the Food Frequency Questionnaire.[39] A different investigation employing a 24 h dietary recall method revealed a reduction in energy intake compared to the initial baseline.[38]

Discussion

In this review, we have provided a summary of the available evidence on different hybrid weight management interventions for weight management in the adult population. Our search identified only a few relevant studies on the topic, and we have included the final 10 that fulfilled the established inclusion and exclusion criteria in this review. The hybrid weight management intervention designs varied among the included studies, and it is worth noting that not all of the studies included dietitians to administer the nutrition intervention. We identified three types of hybrid weight management interventions that emerged as adaptations of the conventional face-to-face approach for dietary intervention in weight management: face-to-face blended with telehealth (telephone coaching); face-to-face with mobile application (self-monitoring with app); face-to-face combined with email message. In certain studies, researchers have explored diverse methods for implementing hybrid weight management interventions such as incorporating personalized feedback and goal setting through digital tools[37] for example email communication,[34] and face-to-face counseling.[39] Despite the array of approaches, there is a consistent trend across the included studies, emphasizing the face-to-face component and leveraging digital health to increase awareness of weight management, thereby improving adherence to the nutrition intervention.

Despite the variability of hybrid weight management interventions, a discernible trend can still be observed. Generally, face-to-face interventions primarily focused on dietary and physical activity consultations, while digital health interventions served as reminders, tools for self-monitoring, providers of personalized feedback, and sources of health information to facilitate behavior change.[34–43] Based on the recruitment years of the included studies, the component of hybrid weight management interventions predominantly relied on telephone coaching and email messages before 2017.[33–38,40] Since then, the introduction of mHealth applications has been observed, either as a supplement to telephone coaching, email messages, and virtual meetings or as a standalone component in digital health interventions.[39,41,42] This transformation aligns with the rising trends of digital health[44,45] and the increasing acceptability rates of digital health technology.[45] Digital health interventions have proven to be a valuable component of healthcare services[46] and have been well-accepted among the obese population.[47,48]

The hybrid weight management intervention overall did not impede weight management efforts, and researchers have indicated its effectiveness among adults.[27,28,37,42] This observation suggests positive implications, indicating a favorable impact on weight status and physical activity levels. However, strong conclusions regarding fruit and vegetable intake cannot be drawn due to the limited inclusion of studies measuring this outcome. A similar finding was reported in recent systematic reviews in this area.[28] For example, Yang et al. conducted a systematic review and found a significant increase in physical activity levels and diet quality. They also observed notable decreases in energy intake, weight, BMI, and waist circumference through hybrid weight management interventions.[28] It is important to note that the reviewed studies included a high degree of participant heterogeneity, whereas our comprehensive review specifically focused on individuals with overweight or obesity individuals. This targeted approach was intended to provide more deeper insights into weight management for this particular population.

Important findings from the present study include the identification of diverse design approaches in hybrid weight management interventions, revealing various potential implementations. In our review, we observed significant variations in the design of hybrid weight management interventions, uncovering a range of combinations and approaches. Half of the studies included in the review were initiated with face-to-face interventions, followed by subsequent digital health follow-up interventions.[34,37,38,42,43] In contrast, the other half of the studies incorporated face-to-face interventions between intervals of digital health

interventions.[35,36,39–41] The lack of consensus in intervention design may be attributed to the early stage of hybrid weight management intervention development, the need for geographical adaptation, as well as the availability of technology. A survey conducted in the United States revealed that 45% of patients expressed their willingness to use smartphones to access telehealth services, while 39% preferred the use of laptops.[8] Conversely, in low and middle-income countries, it was found that mobile communications or mHealth apps were the most widely accepted mode of eHealth.[49] In other words, telecommunication methods enabling patients to access health services remotely, such as through audio calls, video calls, text messages, or chat-based software such as WhatsApp, would be more suitable and acceptable for this population.[50]

Additionally, there appears to be a scarcity of publications evaluating the impacts of hybrid weight management interventions, coupled with a dearth of personalized feedback in nutrition interventions, particularly when hybrid weight management interventions involve face-to-face group education sessions with participants.[34,36,43] This could potentially explain why most studies did not find a significant difference between the control and intervention groups. However, it should be noted that almost all groups in the included studies had experienced weight loss compared to baseline, which could potentially limit the power to detect disparities in weight loss between the groups. Importantly, it is recommended to incorporate personalized feedback in digital health interventions to facilitate weight reduction efforts among adults dealing with overweight and obesity.[51] Personalized feedback provides individuals with tailored information and guidance based on their specific needs and circumstances which has been shown to have beneficial effects in weight loss.[52] It offers individualized support, addresses barriers and challenges, and promotes engagement and empowerment.[38] By leveraging technology, digital health interventions can deliver personalized feedback in a timely, targeted manner, and with an appropriate approach.

This review also highlights a lack of theoretical foundation within the hybrid weight management interventions. More than two-thirds of the included articles did not disclose the use of any behavior change theory or model in implementation of nutrition interventions. The predominant theoretical model found in this review was the Social Cognitive Theory (SCT), a model that has been proven to be an effective model for constructing health behavior by enhancing dietary behavior change.[53] The application of the behavior change model has been reported in different digital health weight loss interventions such as mHealth applications,[54] web-based interventions[55] as well as hybrid weight management interventions.[34,36] To promote health behavior, the utility of the SCT, which promotes a long-term framework, emerges as an important component to facilitate individual behavior in weight loss programs.[56]

Future implications

We uncovered significant implications of hybrid weight management interventions, utilizing various implementation approaches. The hybrid weight management intervention offers greater flexibility[42] and effectively addresses various challenges, such as location barriers faced by individuals in need of treatment,[43] as well as improved cost-effectiveness.[57] It can be an innovative approach to improve the accessibility of the patients. Current review encompassed a sample population consisting of individuals aged above 45–60 years living in developed countries, indicating the feasibility of implementing hybrid weight management intervention among adults. However, it is crucial to ensure that the components of the hybrid weight management intervention are individually tailored.[58] The authors recognized the significance of considering patient preferences regarding the sequence of the intervention[58] and lifestyle behaviors.[41] This consideration is vital, as it could potentially impact individuals' ability to adopt the behavioral changes necessary for weight loss in hybrid intervention. Nevertheless, further research is necessary to delve deeper into its insights and provide valuable guidance for the future implementation of this approach. This may include timely personalized feedback using digital tools, involvement of healthcare professionals (e.g. dietitians), and incorporation of theoretical foundations in hybrid weight management.

Strengths and limitations

The main strength of this review lies in its detailed and systematic search strategy, adhering to the PRISMA guidelines, which facilitated the comprehensive inclusion of relevant studies. Another important strength is the inclusion of contemporary published studies, with many being RCTs to assess the intervention effects. This scoping review has a few limitations. The comparison groups were nonuniform which included the use of waiting-list and usual care groups. Some studies relied on self-reported physical activity levels and food intake, potentially introducing bias in the self-reported data, while also exhibiting varying degrees of study design and approach among the included studies. Therefore, it is prudent to interpret the results of the findings with caution. Some relevant foreign language articles may be hampered as we excluded literature in other languages and solely looked for literature in English. In addition, relevant studies may also be overlooked because key terms or studies beyond the search time frame were omitted.

Conclusion

Findings suggest hybrid weight management interventions are directly related to weight loss and are as effective as individual or group face-to-face weight loss interventions. Most

studies observed a positive effect of the hybrid weight management intervention on body weight, BMI, waist circumference, and physical activity level. Recent studies employed hybrid weight management interventions involving in-person sessions (individual or group) and telehealth or digital apps (mHealth apps). We anticipate that the hybrid weight management intervention approach with different modes of delivery will continue to gain traction and expand its application beyond its current scope. This approach acknowledges the value of telehealth in providing convenient and accessible healthcare, while also recognizing the importance of in-person interactions in weight management. With the advancement of this field, it is anticipated that there will be an increased number of studies exploring the efficacy of this intervention in managing weight and other weight-related outcomes.

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ORCID iDs: Khang Jin Cheah https://orcid.org/0000-0002-1805-4483
Zahara Abdul Manaf https://orcid.org/0000-0002-5657-8608
Arimi Fitri Mat Ludin https://orcid.org/0000-0003-1517-2115

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