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Effects of rebound exercises on overweight and obese adults: A scoping review

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Abstract

Background: Rebounding exercise is a trending aerobic exercise with growing interests in the health industry because of the reported health benefits following minimal physical efforts. Empirically, it seems to have great potential for managing overweight and obesity, highlighting the need to establish a database of related literature. This review aims to scope the literature on the effects of rebounding exercise on overweight and obese individuals' health outcomes.

Method: Experimental trials on the effects of rebounding exercise on health outcomes of overweight and obese individuals written in English within the last decade, between 2009 and 2019. Primary outcome measures included body mass index, blood pressure, quality of life and blood glucose level while secondary outcomes included forced vital capacity and forced expiratory volume in one second. Data extracted were analysed and summarised in tables. The researchers sought for relevant literature in PubMed, Science Direct, Google Scholar, Cochrane Central Register of Controlled Trials and Hinari.

Result: Three studies with a total sample size of 136 participants of mean age of 33.42± 9.3 years and mean body mass index of 29.62±2.72 kg/m^2 were included in this review. Findings proved that rebounding exercise led to an appreciable decrease in body mass index, blood pressure, blood glucose level, and increased quality of life of overweight and obese adults.

Conclusion: Rebound exercise is beneficial for body weight management, blood glucose control, and improvement in the quality of life, hence should form part of obesity management.

The protocol was structured using the Joanna Briggs Institute guidelines for scoping review and registered on Open Science Framework (https://osf.io/rksyb/).

Key words: Mini-trampoline, rebounding, exercise, overweight, obese, adults

Introduction

Rebounding exercise is gaining popularity in the health industry since its emanation as a training tool for athletes and astronauts in the 1980s. It is an exercise performed on a mini-trampoline resulting in the body's vertical movement aided by the mini-trampoline's bouncing effect. Bouncing on a mini-trampoline makes exercise a fun and exciting experience so the individuals do not realise how hard they are actually working [1]. The mini-trampoline rebounding exercise (MRE) can easily be modified to provide effective dynamic components of exercise training such as strength training, balance and coordination, cardiovascular endurance or joint mobility [2]. Risk of fall injuries is prevented by fitted handlebars which provide support and safety. Earlier studies have demonstrated the characteristics and effects of exercise on a mini-

trampoline to the human body, especially when exposed to non-gravity environment [3,4]. These studies describe rebounding as the most efficient form of cellular exercise utilising gravity to maximise gains while conserving efforts. Recently, based on these established consequences of exercise on the human body, scientific researchers have delved into studies investigating the effects of mini-trampoline rebounding exercise on athletic performance [5,6], balance and coordination training [7-9], muscle strength and endurance [9,10] among various populations.

Overweight and obesity have quickly become public health concerns both in developed and in developing countries following the gradual shift from traditional to western lifestyles over the last three decades [11]. According to the World Health Organisation (WHO) [12], overweight and obesity are defined as abnormal or excessive fat accumulation associated with increased risks of chronic diseases such as diabetes mellitus, stroke, cardiovascular diseases, and cancers. These states result from an energy imbalance due to excessive calorie consumption in unhealthy diets with the lack of corresponding energy output or physical exercise. Public health efforts to reduce obesity by encouraging people to eat healthier diets and exercise more frequently have proved abortive as the figures continue to rise [13]. Nevertheless, exercise remains one of the critical therapies for weight reduction in individuals with obesity. Despite the undeniable benefits of exercise in the general population, caution must be taken in prescribing exercise in terms of dosage and types for overweight and obese individuals to reap the benefits and prevent harm. Evidence has revealed that rebound therapy has a link with low risk of workout musculoskeletal injuries because of the even distribution of gravitational forces across all body parts and low ground reaction force resulting in not adding stress to the weight-bearing joints [3,14]. Since overweight and obese individuals are prone to workout injuries connected to their excess body weight, exercise on the compliant mini-trampoline seems to be an ideal form of aerobic exercise compared to traditional exercises like jogging, treadmill, running, skipping or dancing, to name but a few.

Considering the potential values of rebounding exercise in physical and mental therapy and rehabilitation, there has been a growing consciousness of its use in special populations. Studies have reported improved health outcomes in patients with diabetes [15-17], Parkinson's disease [18], human immunodeficiency virus [19], cerebral palsy [20] and stroke [21], as well as in geriatrics [7]. Despite these known beneficial attributes of rebounding exercise, there appear to be limited studies among the overweight and obese population. Nevertheless, understanding the outcomes of the available studies and the mechanisms through which their outcomes were achieved is essential, justyfing this scoping review.

Methods

The protocol for this scoping review was registered with the Open Science Framework (https://osf.io/rksyb/). It analyses experimental trials on the effect of rebounding exercise in adults who are overweight and obese. This review included only experimental trials written in English within the decade between 2009 and 2019. Only scientific journals and peer-reviewed articles were included. The primary outcomes were body mass index (BMI), blood pressure (BP), quality of life (QoL), and blood glucose level while the secondary outcomes were forced vital capacity (FVC), forced expiratory volume in one second (FEV_1) and FEV_1/FVC ratio.

Searches were carried out using several combinations of terms from all fields, and abstract or text of the articles. Firstly, to establish a face

sensitivity and specificity, a PubMed pilot search involving various text terms with specific keywords was conducted. The primary reviewer conducted the pilot search using several combinations of the search terms and selected the most sensitive and specific terms. Secondly, a more detailed search was conducted by three independent reviewers (AJ, CP, CI) from the following databases: PubMed, Science Direct, Google Scholar, Cochrane Central Register of Controlled Trials and Hinari using a combination of the keywords (mini-trampoline, rebounding exercise, overweight, obese, adults). Finally, additional articles were identified through hand searching of the reference lists of selected studies. The results of the literature search were exported to Mendeley to check for duplication of studies. Data management and selection of articles for inclusion were also made on the Mendeley desktop. Eligibility questions and forms for screening the studies to be included were developed, piloted and refined. Screenings were conducted on the title and abstract of selected articles by four independent reviewers (CP, CI, IC, MU) and cross-checked by the primary reviewer. Further screening by reading through the selected articles' full texts using the eligibility criteria (Table 2) was subsequently carried out independently by the reviewers. The information extracted from the included studies which provided answers to the research questions is presented in Table 2 with details on the publication information, sample population, countries in which the studies took place, sample size, research design, methods and key findings. This further screening and the presentation were done and agreed on by three reviewers (AJ, CP, CI).

Results

The PRISMA flowchart (Figure 1) contains the details of the selection process. The reviewers identified 697 articles from the databases, out of which 37 were duplicates leaving a total of 660 articles. Hand searching through the reference lists of selected studies yielded seven extra articles bringing the total to 667. After title and abstract analysis, reviewers excluded 638 articles leaving 29 articles for further full texts' eligibility screening. After the final selection, only three articles remained. Details on the inclusion and exclusion criteria used for assessing these full-text articles' eligibility are described in Table 2.

Three research works with a total sample size of 136 overweight and obese participants were included in this review. Two out of the three studies were randomised controlled trials and utilised random sampling technique to recruit participants (66.7%) while only one study was quasi-experimental. Two included adults who were overweight, while one recruited participants with obesity. The mean age of the included participants is 33.42±9.3 years, while their mean BMI is 29.62±2.72 kg/m^2. The three studies took place in 3 different countries of 3 different continents; Italy (Europe), Nigeria (Africa), India (Asia). The reviewers assessed the risk of bias of the included studies using the Mixed Methods Appraisal Tool (MMAT) version 2018 [22]. All of the studies were of high quality with low risk of bias. Two of the studies utilised a random sampling technique to assign participants into groups and blinded the administrators to the intervention [1,23]. All three had complete outcome data [1,2,23] while two had high adherence to the assigned interventions [2,23]. Although there was no randomisation in the quasi-experimental study, there was clear representativeness of the target population, adherence to intervention protocol, and appropriate measurement of the outcome and intervention [2].

This review included only studies in which the participants underwent several weeks of supervised mini-trampoline rebounding exercise training. Of the three included studies, two

reported that the participants carried out the MRE training for 12 weeks, while one reported only four weeks of MRE training (Table 3). Regarding the frequency of intervention, all studies reported that participants performed exercise training three times per week on non-consecutive days for ≥30 minutes. Some of the studies included additional interventions in their MRE training. Maharaj & Nuhu [23] reported that the intervention group received supervised MRE training and counselling while Shah & Parab [1] reported supervised MRE training and a diet protocol for the intervention group. All participants were adults who were either overweight or obese. Only one study reported a lack of a comparison group [2]. The other two had comparison groups that were randomly assigned and either received only counselling for 12 weeks [23] or diet protocol only for four weeks [1].

The primary outcomes reported in the included analyses were BMI, BP, QoL and blood glucose level [1,2,23] while the secondary outcome was pulmonary function [1]. All the studies showed a reduction in BMI post-intervention while two showed significantly lower resting BP and blood glucose level [2,23]. There was also improved quality of life among the participants post-intervention [2,23]. Shah & Parab [1] reported a significant increase in FEV_1 and FVC with no change in FEV_1/FVC ratio post-intervention. Outcomes were measured at baseline and at the end of the MRE intervention in all studies except for one in which the measurements were taken at baseline, mid-intervention (6 weeks) and the end of 12 weeks intervention [23]. Calculation of BMI is dividing the body weight in kilograms by the square of the height measured in metres. Its expression is in kg/m^2. Measurement of the weight was with a weighing scale while measurement of the heights was with a stadiometer [1,2,23]. Blood pressure was measured using a sphygmomanometer while fasting blood glucose, and glycated haemoglobin evaluations were through a blood test. Short form (SF-36) health survey questionnaire was used to measure health-related quality of life in the study by Cugusi et al. [2] This is a validated instrument containing 36 items divided into eight domains assessing physical functioning, physical roles, bodily pain, mental health, emotional role, social functioning, vitality and general health. Problem Areas in Diabetes (PAID), on the other hand, is a disease-specific self-administered questionnaire which assesses diabetes-specific emotional distress. It has an internal consistency of 0.92 and was used in the study by Maharaj & Nuhu [23] to assess emotional distress in individuals with mild obesity who had type 2 diabetes. Emotional distress is inversely proportional to the quality of life, and its high level translates to reduced quality [24].

Table 1: Search strategy for databases

S/N	Search terms	Database	Filter	Articles retrieved
1.	Mini-trampoline (All field) OR Rebounding (All field) AND exercise (All field) AND overweight (All field) AND obese adults (All field)	PUBMED	2009-2019	34 articles
2.	Rebounding exercise, overweight and obese adults	Science Direct	2009-2019 Review and research articles only	203 articles
3.	Mini-trampoline OR rebounding exercise AND overweight or obese (TX All text)	Cochrane Trials	2009-2019	92 articles
4.	Mini-trampoline, overweight, obese	Google Scholar	2009-2019	354 articles
5.	Rebounding exercise AND overweight AND obese AND adults (All fields)	Hinari	2009-2019 English language Journal articles only	14 articles
			Total	697

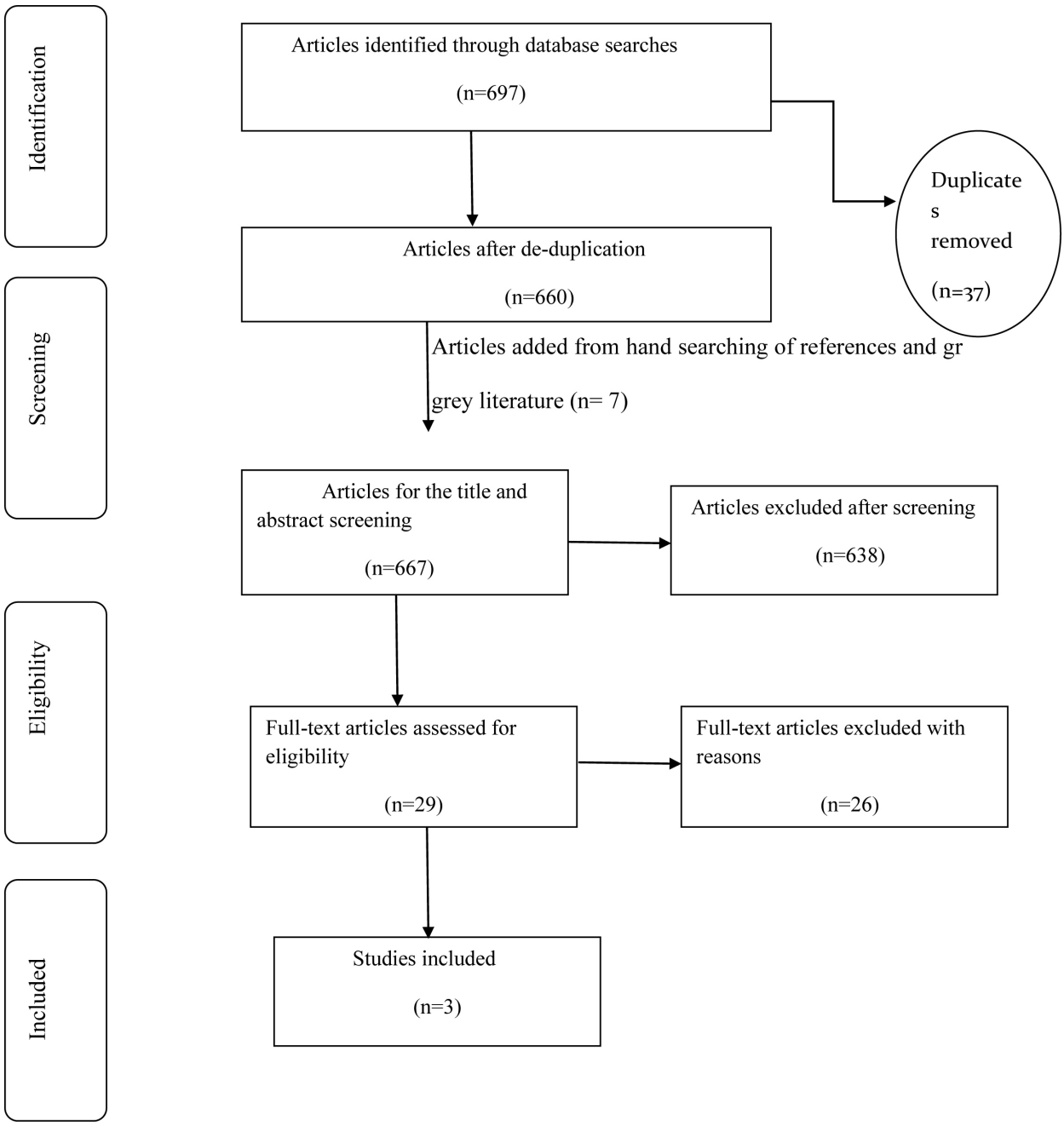

Figure 1: PRISMA flow diagram for the scoping review process [25]

Table 2: Eligibility criteria

Inclusion criteria	Exclusion criteria
Studies wrote in English	Studies published before 2009
Scholarly journal and peer-reviewed articles	Non-scientific reports, commentaries, opinion papers
Studies published within 2009 – 2019	Studies not written in English
Experimental and quasi-experimental studies	Studies with participants that are not overweight or obese
Focus on mini-trampoline/rebounding exercise	
Health outcomes include BMI, blood pressure, blood glucose and quality of life	
Studies on overweight or obese adults as the participants	

Table 3: Study characteristics

S/N	Authors/ Year	Title	Population	Country	Sample size/ Sampling technique	Outcome	Design	Method	Key findings
1.	Cugusi et al., 2018 [2]	Effects of a mini-trampoline rebounding exercise programme on functional parameters, body composition and quality of life in overweight women	Overweight women	Italy	18/Purposive sampling	BMI, BP, Quality of life, fasting blood glucose	Quasi-experimental	Twelve weeks of mini-trampoline rebounding exercise training done three times a week for approx. 55-60 minutes	This study offers evidence for the benefits of the novel MRE intervention in controlling body weight, improving cardiopulmonary performance, fasting blood glucose and QoL in overweight women.
2.	Maharaj & Nuhu, 2019 [23]	Mini-trampoline rebound exercise: A self-care initiative for glycated haemoglobin, BMI and emotional distress for mildly obese females with non-insulin-dependent type 2 diabetes.	Mildly obese females with type 2 diabetes	Nigeria	54/ Computer-generated random sampling	BMI, BP, emotional distress, glycated haemoglobin	Randomised controlled trial	12 weeks of supervised MRE training three times each week for 30 minutes and counselling	There was a significant reduction in BMI, blood pressure and glycated haemoglobin as well as emotional distress
3.	Shah & Parab, 2018 [1]	Effect of rebound exercises in overweight individuals on BMI, WHR and lung function: A randomised controlled trial	Overweight individuals	India	64/Simple random sampling	BMI, WHR, Lung function	Randomised controlled trial	Four weeks of supervised MRE and diet protocol three times every week for 40 minutes	There was a significant reduction in body weight, waist circumference, FEV1 and FVC but no difference in the WHR and FEV1/FVC after four weeks of intervention.

FVC - forced vital capacity, FEV_1 - forced expiratory volume in one second, WHR - waist-hip ratio, BMI - body mass index, BP - blood pressure, QoL - quality of life, MRE - mini-trampoline rebounding exercise

Discussion

This scoping review sought to identify and map out the existing literature on the effects of rebounding exercise in overweight and obese adults. Only three articles were included in this review highlighting the limited body of literature on this topic. This scarcity reveals a dearth of published data on the effect of rebounding exercise among adults who are overweight and obese worldwide despite the compelling proof of the beneficial effects of the therapy. Also, the geographical representation of the included studies buttresses the fact that most of the world health systems were not reflected as there were not any analyses from major health stakeholders like the United States, Canada, Australia, Japan, Germany or Spain. Findings from this scoping review reveal that rebounding exercise on the mini-trampoline leads to an appreciable decrease in BMI and resting blood pressure of overweight and obese adults compared to the control irrespective of the length of training duration. Cugusi et al. [2] subjected their participants to 12 weeks of MRE exercise three times every week for 55-60 minutes each session and reported a significant decrease in BMI and blood pressure.

Similarly, a significant reduction in BMI and blood pressure was observed by Maharaj & Nuhu [23], who conducted a 12 weeks mini-trampoline rebounding exercise and counselling three times per week for 30 minutes. However, another investigated study which conducted only four weeks of mini-trampoline rebounding exercise, three times weekly for 40 minutes each session and diet protocol also observed a significant BMI reduction [1]. This finding shows that rebounding exercise alone effectively improves body weight and blood pressure when carried out with other behavioural therapies.

This review further shows that rebounding exercise significantly lowers blood glucose levels in overweight and obese adults [2,23]. This finding is in line with previous pieces of literature which reported an impressive reduction in blood glucose levels in both normal and special populations after rebounding exercise training. For instance, a study conducted on 24 normoglycemic adults reported a significant decrease in blood glucose levels after rebounding exercise on a mini-trampoline compared to the control [26]. A similar analysis on patients with diabetes mellitus observed a significant reduction in blood glucose through improved insulin resistance after 12 weeks of mini-trampoline rebounding exercise [23]. Furthermore, other outcomes, such as improved FVC and FEV_1 with no change in FEV_1/FVC ratio, were noted [1]. Rebounding on a mini-trampoline exposes the individual to fluctuating gravitational forces that stimulate every cell in the body, including the insulin receptors, thereby improving insulin resistance and glucose uptake by working muscles. This continuous vertical propulsion accompanying MRE also strengthens the cells all over the body, reduces arterial pressure, and improves oxygen consumption and lung function with minimal stress on the body [27]. Therefore, it is conceivable that rebound therapy helps regulate blood glucose level and improve pulmonary function.

Studies have reported that various aerobic exercise protocols improve the quality of life in overweight and obese adults [28-30]. Findings of this review corroborate these conclusions as two of the included studies reported a significant improvement in the quality of life following mini-trampoline rebounding exercise [2,23]. Anecdotal reports from the participants of an included study suggested that they enjoyed the euphoria and stress release associated with rebound therapy's bouncing effect [23]. This experience and the release of the 'feel good' hormone, endorphin, associated with aerobic exercise make it understandable that quality of life would increase with rebound therapy.

This scoping review has identified some gaps in the literature. For instance, despite the overwhelming evidence on the benefits of rebounding exercise to humans, there is still a paucity of data relating to its effects in special populations, including overweight and obese individuals. Moreover, little scientific evidence is insufficient to cover the world health system in terms of geographical representation as related studies are yet to emerge from many countries. To the best of the reviewers' knowledge, this scoping review is the first conducted on the effect of rebounding exercise therapy in adults who are overweight and obese. Furthermore, the included studies were of high quality and had a low risk of bias. However, a major constraint to this review is the scarcity of evidence on the effects of rebound therapy among overweight and obese adults, making it difficult to discuss the findings and draw definite conclusions adequately. Another limitation is the inclusion of only scientific and peer-reviewed articles that may have diminished this work's scope. The clinical implication of this study is that since individuals who are overweight and obese are prone to work out injuries due to excess weight, the mini-trampoline's soft and compliant surface provides a unique means of enjoying all the benefits of aerobic exercise at minimal cost or stress to the body. Hence, rebound therapy can be incorporated into the routine management of obesity.

Conclusion

This scoping review highlighted the effectiveness of rebounding exercise in adults who are overweight and obese. It revealed that several weeks of rebounding exercise training leads to a marked improvement in BMI, blood pressure, blood glucose level and life quality. However, the reviewers advise taking this finding with caution because of the very few studies included. There should be further research into the beneficial effects of rebound therapy. We recommend conducting randomised controlled trials following the basic guidelines for reporting trials to minimise bias.

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