

Impact of Physical Activity on Physical and Mental Health of Postmenopausal Women: A Systematic Review

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ABSTRACT

Introduction: Menopause is associated with a variety of physical and mental issues. It's critical to pay attention to postmenopausal women's health issues and develop prevention strategies.

Aim: To evaluate association between physical activity and physical and mental health problems in postmenopausal women.

Materials and Methods: In the present systematic review, relevant studies were searched in international electronic databases such as, Cochrane Central Register of Controlled Trials (CENTRAL), PubMed and Google Scholar from 2004 to 2021. Terms like physical activity, physical health, mental health, bone mineral density, exercise training, and postmenopausal women were searched. All papers were screened for eligibility. Inclusion criteria of the study was, studies with atleast one exercise group versus one control

group, should include women who were postmenopausal at the time of the study, studies that examined effect of physical activity on physical and mental health of postmenopausal women, full text articles written in English language.

Results: Total 27 studies were included in the present review. The results revealed that resistance, aerobics, walking, pilates and aquatic exercises have shown benefits in improving physical and mental health parameters of postmenopausal women.

Conclusion: Physical activity plays a great role in maintaining overall health and Quality of Life (QOL) of Women. To avoid fractures, these women should engage in workouts with prudence. Physical and mental fitness can be achieved by incorporating exercise into daily routine of postmenopausal women.

Keywords: Depression, Exercise, Menopause, Psychological health, Quality of life

INTRODUCTION

Menopause is described as the end of a woman's menstrual cycle followed by a 12-month phase of amenorrhoea. The term "postmenopause" refers to the time after the last menstrual period [1]. Menopause is the most noticeable event that occurs in women during middle age as it marks the end of a woman's reproductive life. Natural Menopause (NM) occurs between the ages of 45 and 55 years old over the world [2]. Early menopause has been linked to an increased risk of cardiovascular disease and osteoporosis, whereas delayed menopause has been linked to an increased risk of breast cancer and endometrial cancer [3]. It has been reported that, women who are physically inactive may experience physical and mental health problems during their menopause [4,5].

Symptoms such as hot flashes, irritability, sleeping difficulties, exhaustion, anxiety, and loss of focus are seen in the early postmenopausal era depending on the ovarian function deficit and, as a result, lack of oestrogen. Due to the decrease of oestrogen's preventive actions in the late period, the incidence rate of osteoporosis and obesity rises. These symptoms in the postmenopausal period have a negative impact on women's quality of life [6]. Osteoporosis is most commonly seen in women, with a considerable rise in incidence following menopause [7]. Decline in bone mass consequently leads to fragility of bones and enhanced risk of fracture in postmenopausal women [8,9].

Although, majority of women have transition to menopause without encountering psychiatric issues, an estimated 20% of women experience depression during this time [10]. There are several factors that contribute to menopausal depression. Previous history of depression; personal and societal concerns; loss of motherhood, husband's impending death, negative views regarding menopause, long-term menopause, and so on are some of these variables [10, 11]. According to some experts [12] depression during menopause is caused by a drop in gonadal hormone levels, which causes exhaustion, sleep loss, and hot flashes. Biopsychological

factors, relationship with husband, educational level, race, and demographic characteristics, on the other hand, have been linked to depression following menopause by certain researches [13,14]. Some believe that depression in this age group is more closely linked to psychosocial events such changes in child-parent relationships, marital status, and other life events [15].

Physical inactivity causes various physical and mental health problems in postmenopausal women and these are linked with menopause. Physical activities on the other hand are thought to be vital for physical and mental health of postmenopausal women [15]. The role of exercise in the prevention of postmenopausal symptoms has been debated and recognised. According to the authors, encouraging women over the age of middle age to exercise regularly can dramatically reduce postmenopausal symptoms [15,16]. Literature has reported that sustained and long duration physical activity improves mental functioning [16,17]. Furthermore, the authors pointed out that physical therapy could improve patients health fitness and hence, quality of life [18,19]. The literature, on the other hand, has devoted little attention to the probable association between physical activity/exercise and physical or mental health.

To the best of authors' knowledge, limited reviews have been published on this topic. Attention needs to be paid to their health issues to establish strategies to prevent these problems. The purpose of the present review was to analyse the impact of physical activity on physical and psychological health of postmenopausal women. Physical activity interventions were evaluated on adiposity markers, bone density, functional capacity measurements, and various psychological health outcomes in postmenopausal women in the current systematic review.

MATERIALS AND METHODS

In the present systematic review, relevant studies were searched in International electronic databases such as, Cochrane CENTRAL, PubMed and Google Scholar from 2004 to 2021.

Search terms: So as to make search more precise MESH terms and Boolean operators were used. Combinations used for search was (Postmenopausal OR Postmenopausal OR Menopausal) AND (Physical activity OR Exercise OR Exercise Training OR Physical fitness) AND (Physical health OR Body composition OR Body weight OR Bone Mineral Density OR Bone Mass or Body Fat) AND (Mental health OR Psychological health OR Depression).

PICO Framework

Participants: Women who were postmenopausal at the time of study.

Interventions: A physical activity/exercise intervention was required in all the studies. All types of interventions were included except rehabilitative protocol. Both individual and group activities were included.

Comparator: All publications included either a comparison group with different type of physical activity intervention or a control group who were either sedentary/continued with their usual routine.

Outcome measures: Physical and Mental health measures.

Inclusion criteria: Studies/study arms that had:

- At least one exercise group versus control group consisting of a sedentary/habitual active lifestyle or different type of physical activity intervention;
- Research participants who were postmenopausal at the time of study;
- Studies on the impact of physical activity on postmenopausal women's physical and emotional well-being;
- Full text articles written in English language and published in peer-reviewed journals were included in the review.

Exclusion criteria: Publications that were:

- Published in language other than English;
- A review article; or
- A case report;
- Cross-sectional surveys were excluded.

Study Procedure

The eligibility process was divided into phases with clear inclusion and exclusion criteria. The review included only full-text academic publications published in peer-reviewed journals, excluding magazine and newspaper articles. In phase I, 3720 documents from three databases were identified using the search phrases. After removal of duplicate papers, 1861 papers were identified. The third phase introduced a new search category with papers pending under all established search strings. All full-length texts were thoroughly reviewed in phase IV, and papers that had no relevance to the study's objectives and research issues were eliminated. Finally, 27 articles were chosen, and the results were summarised [Table/Fig-1].

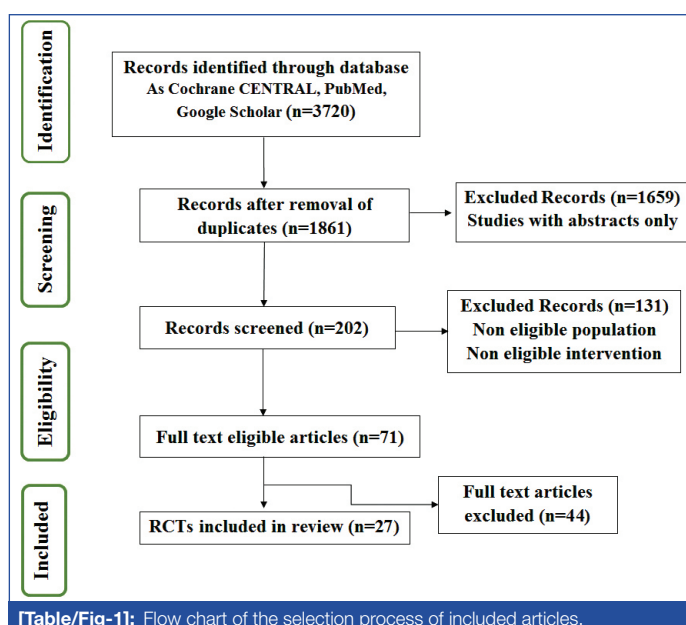
Data extraction: Data for all physical and mental outcomes was gathered. A wide range of measures were used to examine outcome factors. Body composition, bone density, bone mass and physical fitness components were the physical parameters. Anxiety, depression, and QOL were the mental health outcomes.

Data analysis: Two reviewers (SK) and (SP) independently extracted the data.

Risk of Bias analysis: The risk of bias was assessed using Cochrane Risk of Bias analysis tool.

RESULTS

The data on year of study, participants, study duration, sample size, specifications of intervention, outcome measures, and study findings were tabulated. [Tables/Fig-2] [20-39] and [Tables/Fig-3] [40-46] summarise the findings from the RCTs. Result for risk of bias has been presented in [Table/Fig-4] [20-46].



DISCUSSION

During the menopausal stage, women may experience a variety of symptoms as a result of ageing and changes in sex hormone levels, which can have a severe impact on their quality of life, physical and mental health [47]. Despite consistent evidence of a positive relationship between physical activity, physical fitness, or exercise and cardiovascular health and quality of life during the menopausal transition, the relationship between menopause symptomatology and physical activity, physical fitness, or exercise is still controversial [48,49]. Increasing physical activity or improving physical fitness has been shown, in several studies, to be an effective means of preventing or alleviating menopause-related symptoms [50,51]. Similarly, exercise programmes have been shown to improve menopause symptomatology, particularly in the postmenopausal stage [52]. Some research, on the other hand, have failed to uncover clear connections, implying that increasing physical activity levels or specialised exercise regimens for addressing menopause symptoms may not be the cure [53,54]. The current study looked at the link between physical activity and physical and mental health in postmenopausal women, as well as the effects of different types of physical activity or exercise on physical and mental parameters.

The present study finding suggest that there are various exercise training for improvement of physical health parameters like resistance training, Tai Chi, weight bearing training, aerobic exercise, aquatic resistance training etc. Four studies in the present review reported that resistance training significantly improved Bone Mineral Density (BMD), enhanced bone metabolism and reduced bone resorption [27,31,35,37]. One study demonstrated combination of strength and balance training had positive effects on bone health of menopausal women [28]. Studies by Chubak J et al., and de Matos O et al., dematos reported adherence to exercise helped in conserving BMD but there was no significant difference with the control group [22,26]. Other exercises like aquatic exercises, Tai Chi and Pilates also helped reducing bone resorption in postmenopausal women [22,34,38]. Six studies reported positive effects of exercises like aerobics, aquatic therapy, pilates and functional exercises on physical fitness, QOL and functional capacity of postmenopausal women [21,24,28,32,35,36]. A six weeks aerobic exercise in combination with Hormone Replacement therapy (HRT) were found to be effective in improving strength, endurance, flexibility, balance in postmenopausal women [21]. Therefore, it is recommended that it should be combined with exercise training to get the best results and anthropometric measures in postmenopausal women. Resistance and aquatic training [26,28,29] also improved the physical parameters like BMD, body fat, Diastolic Blood Pressure (DBP) and

Author and year of publication	Aim	Protocol	Tool	Outcome	Conclusion
Chan K et al., 2004 [20]	The goal of this study was to see if scheduled Tai Chi Chun (TCC) exercise may help prevent bone loss in early postmenopausal women.	A total of 132 healthy postmenopausal women (mean age 54.0±3.5 years) were selected and randomised into exercise group (n=67) or the control group (n=65) within 10 years of menopause onset. The TCC group did 45 minutes of supervised TCC activity five days in a week for one year, while the control participants continued to live a sedentary lifestyle	Bone Mineral Density (BMD)	At all assessed skeletal sites, BMD measurements revealed general bone loss in groups albeit at slower rate in the TCC group.	In early postmenopausal women, TCC exercise intervention helps to prevent bone loss in weight-bearing bones.
Teoman N et al., 2004 [21]	To investigate efficacy of exercise intervention on QOL and fitness of menopausal women.	A total of 81 subjects (51.0±3.9 years) were recruited Two groups: exercise (n=41) and control (n=40) Aerobic exercise three times a week for six weeks was given. No exercises for control group.	Physical fitness parameters and Nottingham Health Profile (NHP)	Significant differences were found in strength, endurance, flexibility, balance and in NHP.	It can be concluded that fitness level and quality of life can be improved by regular physical activity or training.
Chubak J et al., 2006 [22]	To study effects of exercise on BMD and fat free mass in postmenopausal women.	A total of 173 sedentary, postmenopausal women in the age group of 50-75 years were divided into aerobic exercise group or control group for 12 months. The exercise prescription included more than 45 minutes of moderate intensity five days a week. In control group, stretching sessions lasting 45 minutes were held once a week for the control group.	Fat percentage, fat free mass, and BMD	Control group gained weight while aerobic intervention group lost weight. There were no changes in bone density, bone mass and fat free mass between exercisers and controls. Similarly, no significant changes in bone mineral composition were found.	A year of moderate-intensity aerobic exercise helped in losing body weight but has no effect on whole body bone mineral density, bone mineral content, or lean mass in postmenopausal women, according to the findings of this randomised controlled trial.
Karacan, S 2009 [23]	To investigate the effect of 24 week aerobic calisthenic exercise on physical fitness of postmenopausal women.	A total of 65 postmenopausal women (50.13±3.38 years) were recruited. A 55-minute aerobic exercise program was given three times a week for 24 weeks. According to the Karwoen formula, training intensity was kept 75-80%.	Physical parameters, Menopause RatingScale	Significant reductions were found in Body Mass Index (BMI), body fat, Blood Pressure (BP) and resting Heart Rate (HR) and aerobic power, flexibility, sit up, pushup, hand grip increases.	Positive effects on physical fitness parameters and menopausal symptoms were noted.
Colado JC et al., 2009 [24]	To investigate the effects of 24 weeks of aquatic resistance training on physical fitness.	Total 46 postmenopausal women were included. 3 groups: Aquatic exercise (n=15), Elastic band group (n=21) and control (n=10). Total duration of exercise: 35 min for 1-4 weeks, 40 min for 5-8 weeks, 50 min for 9-12 weeks, 45 min for 13-18 weeks and 60 min for 19-24 weeks.	Physical fitness parameters	Aquatic and elastic band group showed improvement in body fat, Diastolic Blood Pressure (DBP), sit and reach, knee pushups and 60-seconds squats.	Positive results were found in aquatic and elastic band group on overall health of postmenopausal women.
Velthuis MJ et al., 2009 [25]	To see how a 12-month moderate-to-vigorous exercise programme combining aerobic and muscle strength training affected body composition in postmenopausal women who were sedentary.	A total of 189 sedentary postmenopausal women (aged 50-69 years,) were randomly allocated to one of two groups: exercise (n=96) or control (n=93). A one-year moderate to intense exercise programme was used as the intervention. The exercise programme includes two one-hour supervised group sessions per week and a half-hour home-based solo session each week. The group exercise sessions were offered in six fitness establishments to groups of 15 to 20 women.	Weight, BMI, Body circumference, Body fat percentage	Weight, BMI, and hip circumference did not change significantly as a result of the exercise regimen. When compared to the control group, the exercise group lost a statistically significant amount of total body fat, both in absolute terms and in percentage terms. In addition, compared to the control group, lean mass increased significantly (+0.31 kg), while waist circumference fell significantly (0.57 cm).	A 12-month exercise programme combining aerobic and muscle strength training had no effect on weight but had a positive impact on postmenopausal women's body composition. Because it is an independent risk factor in both obese and non obese adults, it may have significant health effects.
de Matos O et al., 2009 [26]	To investigate effects of resistance training on BMD.	A total of 59 women with osteoporosis were enrolled. The Study Group (SG, n=30; 57.5±5.1 years) and the Control Group (CG, n=29; 56.6±4.6 years) were divided into two groups. A 12- resistance exercise regimen was used in the study group, while no weight exercise routine was used in the control group.	BMD	Despite the fact that there were no significant inter group differences, patients in the SG group had a rise in bone density in the lumbar spine, whereas patients in the CG group had 1.17% increase.	Although the weight training exercise protocol did not significantly improve BMD in postmenopausal women, the results showed the importance of following the specific exercise programme for maintaining bone health in postmenopausal women when compared to the control group.
Bocalini BC et al., 2009 [27]	To investigate effects of resistance training on BMD.	A total of 40 women in age of 40-75 year Groups: Untrained (UN) or Trained (TR). Training regimen included three 1-hour resistive exercise sessions per week on non consecutive days. The workout began with a 10-minute warm-up set followed by one set at 50% of the one repetition maximum load (1RM). The study duration was 24 weeks	Body composition, muscular strength, and BMD	Only the TR group had decreased body weight, mass index, and fat percentage. Strength training (ST) improved one repetition maximum. At the lumbar spine and femoral neck, the UN group had a larger proportion of demineralisation than the TR group.	In postmenopausal women, 24 weeks of ST improved body composition markers, enhanced muscular strength, and conserved BMD.
Bolton KL et al., 2012 [28]	To evaluate effect of exercise programme on postmenopausal women with osteopenia.	Thirty-nine women with age >50 Groups: Exercise (EX) or Control (CON). EX participants (n=19) did activities targeting balance and strength three times per week for 52 weeks. They did daily jumping workouts at home as well. Participants in the CON (n=20) went about their routine as usual.	BMD, quality of life, muscle strength and endurance	Ex-participants improved by 0.5%, but CON participants lost 0.9 percent. The only additional differences between the groups were in QOL and a measure of trunk and upper limb endurance, both of which favoured the EX group.	For postmenopausal women with osteopenia who are not using bone-building medication, this exercise regimen appears to produce minor benefits. Although this kind of exercise delivery has limits in terms of adherence and advancement, it may be appropriate to prescribe for some persons.

Swift DL et al., 2012 [29]	The goal of this study was to see how habitual amounts of physical activity during aerobic training affected weight, waist circumference, fitness, and blood pressure.	For six months, women (n=325) were randomly assigned to aerobic training of 4, 8, or 12 kcal/kg per week and a control group.	Weight Waist circumference	In aerobic training groups, waist circumference reductions were significantly greater with higher steps/day accumulated outside exercise training compared to lower levels. In the 4 kcal/kg per week group (p-value=0.04), there was a trend for greater weight loss with increased steps per day, but not in the other exercise dosages (p-value=0.04). Blood pressure and fitness measurements had no influence (all p-value >0.05).	Higher levels of habitual physical activity while participating in aerobic training was linked to bigger reductions in central adiposity and was more supportive of weight loss in postmenopausal women than lower levels.
Moreira L et al., 2013 [30]	To study effect of 24-week high-intensity aquatic exercise programme on bone remodelling markers and bone mass in postmenopausal women.	A total of 108 women (58.8±6.4 years), randomised into Aquatic Exercise Group (AEG), n=64, performing 24 weeks of aquatic exercises, and Control Group (CG), n=44, sedentary women who continued with their normal routine.	Bone markers, Bone mass, BMD	A significant increase in bone formation marker (P1NP) only in the AEG, and while both groups had large increases in bone resorption marker (CTX), the AEG's increase was less significant. At the end, IPTH levels in the CG had increased by 19% (p=0.003). The CG was reduced by 1.2 percent (p=0.009) in the femoral trochanter BMD, while there was no change in the AEG (p=0.069).	The aquatic exercise programme was effective in lowering bone resorption and increasing bone production.
Zaki ME, 2014 [31]	To see how whole-body vibration and resistance exercise affected bone density and anthropometric measures women who were obese.	A total of 80 women in the age group of 50-68 years were selected. Experimental group performed resistive training programme for eight months. For a total of 10 repetitions, all individuals began the workout programme with a 10-repetition maximum load for each exercise (one set). Control group received Whole Body Vibration (WBV) group.	BMD (DEXA) and anthropometrical parameters	Both interventions improved BMI and WHR.	Significant association was seen between physical activity and anthropometric measures and BMD
Neves LM et al., 2014 [32]	Examine the impact of 8 weeks of functional exercise on postmenopausal women's body composition.	A total of 38 postmenopausal women were enrolled in the study: Training Group (TG) and Control Group (CG). Participants in the TG (n=21) completed a physical exercise programme three times a week on non consecutive days for eight weeks, with each session lasting 90 minutes. Women in the CG (n=17) did not engage in any type of systematic physical activity	Dual-Energy X-ray Absorptiometry (DEXA), Functional capacity	Significant differences were found between TG and CG after 8 weeks of training in trunk fat, total body fat (kg) and total weight. Both groups demonstrated a reduction in absolute values, but not significant, in percentage of total fat.	Functional exercise in a circuit pattern can be used to help postmenopausal women improve their body composition, especially when it comes to reducing adipose tissue.
Kemmler W et al., 2015 [33]	To study how exercise affected overall fracture incidence and Bone Mineral Density (BMD) in elderly people who were at risk.	A total of 137 early-postmenopausal, were recruited. The exercise group (EG; n=86) was asked to participate in two supervised group and two home exercise sessions per week, whereas the control group (CG; n=51) was asked to maintain their physical activity. The 20-25 minute warm-up/endurance routine began with 5-10 minutes warm up, followed by 10-15 minutes of low- and high-impact aerobic dance activities at 70-85 percent of maximum heart rate (HRmax) and peak ground reaction forces (peak GRF) at 2-3 body weight.	BMD	BMD decreased in both groups; however, the reduction was more pronounced in the CG	The great antifracture efficiency of multipurpose exercise programmes were clearly demonstrated in this study.
Angin E et al., 2015 [34]	To study effect of clinical Pilates exercises on BMD, physical performance, and quality of life (QOL).	Forty-one women in age group of 40-69 were split into two groups, one for Pilates and the other for control. Pilates group was given training 3 days a week, 1 hour per session for 24 weeks. Control group was not given anything	BMD, Physical performance measures, pain intensity, QOL	In the Pilates group, BMD increased (p-value <0.05), but in the control group, BMD dropped (p-value <0.05). The Pilates group exhibited significant improvements in physical performance compared to control.	Pilates exercises are useful in increasing BMD, QOL, and walking distance, as well as providing pain relief.
Borba-Pinheiro CJ et al., 2016 [35]	To study effects of strength training on BMD, strength and QOL	A total of 52 volunteers aged over 50 years. 3 groups: RT1 (n=20) 3 times per week, RT2 (n=16) 2 times per week, Control group (n=16) for 13 months. Intensity varied between 60% to 90% according to 10 RM.	BMD, 10 RM test, Osteoporosis Assessment questionnaire (OPAQ)	It was found that RT3/week was significantly most effective than RT2/week.	Both experimental groups showed favourable results in all the variables but RT3 showed best results as compared to other groups.
Wen HJ et al., 2017 [36]	To study how short-term group-based step aerobics (GBSA) exercise affected bone metabolism, BMD, and functional fitness	A total of 48 PMW (aged 58.2±3.5 years) with poor bone mass were recruited and allocated to either an Exercise Group (EG) or a Control Group (CG). The EG participants took part in a 10-week GBSA exercise programme that included three 90-minute sessions per week at an intensity of 75-85 percent of heart rate reserve.	Serum bone metabolic markers BMD, and functional fitness components	There was no significant difference in osteocalcin levels between the two groups. BMD did not alter significantly in either group. Furthermore, the EG's functional fitness components were greatly enhanced, as evidenced by considerable improvements in lower- and upper-limb muscular strength and cardiovascular endurance.	In PMW with low bone mass, short-term GBSA exercise enhanced bone metabolism and overall health by dramatically reducing bone resorption activity and improving functional fitness.
Watson SL et al, 2018 [37]	The goal of the trial was to see if High intensity resistance and impact training (HiRIT) could lower fracture risk characteristics in postmenopausal women with low bone mas	A total of 101 women in the age group of 65 to 75 years, took part in the study HiRIT (n=49), CON (n=52). Postmenopausal women with low bone mass were recruited and randomly assigned to either an 8-month supervised HiRIT (n=49) or a home-based (n=52), that were given low-intensity exercise programme (CON).	BMD, Functional performance measures	For Lumbar Spine (LS) BMD, HiRIT effects were superior to CON	In postmenopausal women with poor bone mass, a brief HiRIT programme improves indexes of bone strength and functional performance.

Wochna K et al., 2019 [38]	To Study effect of aquatic training on bone health	A total of 18 postmenopausal women in age group of age 54-65 years were divided into two groups: Experimental and control. Over the course of six months, participants in the experimental group performed 45 minute aquatic exercise every week.	BMD, biochemical parameters of serum osteocalcin (OC) and C-terminal telopeptide of type I collagen.	During the training there was a significant difference in strength index of femur with better results in experimental group.	Aqua fitness training programme improved femur strength index in postmenopausal women, suggesting that this type of exercise could be a beneficial form of physical activity for them.
Hettchen M et al., 2021 [39]	To study effect of 18-month multifunctional exercise programme affected risk factors and symptoms associated with menopause.	Fifty four women were randomly assigned to one of two groups: 1) high intensity resistance exercise group (EG: n=27) or 2) control group (CG: n=27) exercising once a week. The intervention was broken up into 10-12 week blocks of high-effort training, with some weeks of recreational activity in between.	BMD, fat free mass, fat percentage, metabolic syndrome score, symptoms related to menopause and power and strength of muscle	Significant impacts for BMD-LS were seen. Fat free mass decreased in EG but remained same in CG. No difference was seen in Metabolic syndrome score.	The multifunctional exercise routine tailored to early-postmenopausal women on a variety of risk factors and complaints associated with the menopausal transition was found to be effective.

[Table/Fig-2]: Effect of physical activity on physical health [20-39].

Author and year of publication	Aim	Protocol	Tool	Outcome	Conclusion
Elavsky S and McAuley E, 2007 [40]	Effect of exercise on mental health outcomes	Included total 164 low active middle aged women (mean age- 49.9 years). Participants completed body composition and fitness assessment and a battery of psychological measures at the beginning and end of a 4-month randomised controlled exercise trial with three arms: walking, yoga, control. Three times per week for 1 hour, exercise intensity based on Karnoven method-starting from 50% to 75% of Heart Rate Reserve (HRR).	Mental health parameters and Quality Of Life (QOL)	It was observed that walking and yoga enhanced positive affect and reduced negative affect.	Walking and yoga were found to be effective in improving mental health and QOL.
Agil A et al, 2010 [41]	The goal of this study was to see how different short-term exercise programmes affected postmenopausal women's symptoms OF menopause, QOL and mental health.	Total 42 women were recruited. The study comprised women between the ages of 45 and 60 years. They were split into aerobic and resistance and exercise groups at random. Under the guidance of a physiotherapist, the women exercised three times each week for eight weeks. A bicycle ergometer was used to do aerobic exercise training.	Lipid profile, depression, QOL	There were no significant differences in lipid profiles in either groups. Resistance exercise group showed improvements in Menopausal Rating Scale. In both groups, depression levels dropped dramatically.	Menopausal symptoms, psychological health, depression, and quality of life were all found to be improved by resistance and aerobic exercise.
Bernard P et al., 2014 [42]	To study effect of walking intervention programme on the incidence of depressive symptoms.	A total of 121 people between the ages of 57 and 75 years were randomly assigned to either a six-month moderate intensity walking intervention (three times per week, 40 minutes per session, supervised and home-based) or a control group (waiting list).	International Physical activity Questionnaire (IPAQ), Beck Depression Inventory(BDI)	Compared with controls, participants in the walking intervention demonstrated a significant reduction in depression. Post-intervention BDI score predictors included the baseline cognitive-BDI subscore, subjective health status, body mass index, and adherence.	In postmenopausal women at risk of depression due to physical inactivity, a six-month, three sessions per week moderate intensity walking intervention with a minimum 50% adherence rate lowers depression.
Abeidi P et al., 2015 [43]	The goal of this study was to see how pedometer-based walking affected postmenopausal women's anxiety, sleeplessness, and depression.	Total of 106 postmenopausal women were randomly allocated to one of two groups (n= 53 in each group). The intervention group was given a pedometer and instructed to raise their step count by 500 each week.	The Global Health Questionnaire-28(GHQ-28) and Beck questionnaires were used to assess their anxiety, sleeplessness, and depression levels	When compared to the control group, anxiety and sleeplessness levels in the intervention group decreased. The intervention group's step count improved from 76,377 steps per month in the first month to 1,06,398 steps per month in the third month (p-value=0.001).	Walking with a pedometer had a favourable effect on sadness, sleeplessness, and anxiety in postmenopausal women, according to one study. In Iran, postmenopausal women may benefit from a walking exercise programme.
Hu L et al., 2017 [44]	To examine the effects of four months walking on menopausal symptoms and mental health.	For four months, 91 women between the ages of 45 and 65 years were studied. For 16 weeks, the walking group met three times a week for one hour- 40 minutes at an intensity corresponding to 60% of HRR+ 10 minutes of pre-exercise warm-up and post-exercise cool-down.	Mental and physical parameters (BMI, menopausal symptoms and depression)	Walking was effective in reducing menopausal symptoms and depression.	Walking could be recommended to manage menopausal symptoms and promote psychological well being.
Takahashi M et al., 2019 [45]	To study the efficacy of daily physical activity on markers of depression.	This study included postmenopausal women (70.2±3.9 years) Active group wore an accelerometer for a duration of eight weeks. Intensity of Physical activity was determined in terms of Metabolic equivalent	Mental health parameters and blood sample	The active group's step counts increased after eight weeks. In the Active group, serum concentrations of brain derived neurotrophic factor and serotonin increased.	Physical activity has positive effects on depression biomarkers of postmenopausal women.
Aibar-Almazan A et al., 2019 [46]	To study efficacy of Pilates exercise on sleep quality, depression and fatigue in postmenopausal women.	110 women (mean age: 69.15±8.94 years) 12 weeks Pilates exercise program- two sessions per week: 10 min warm up +35 min Pilates Training +10 min cool down.	Pittsburgh sleep quality index (PSQI), Fatigue severity scale, Hospital Anxiety and Depression Scale (HADS)	Significant improvement was observed on sleep and mental health.	12 weeks Pilates exercise intervention has beneficial effects on sleep quality, anxiety, depression and fatigue.

[Table/Fig-3]: Effect of physical activity on mental health [40-46].

Author and year of publication	Random sequence generation	Allocation concealment	Blinding of patient and personnel	Blinding of outcome assessment	Incomplete outcome data addressed	Selective reporting	Other bias
Chan K et al., 2004 [20]	Some concern	Some concern	High	High	Low	Low	Low
Teoman N et al., 2004 [21]	Low	High	High	High	Low	Low	Low
Chubak J et al., 2006 [22]	Low	High	High	Low	Low	Low	Low
Karacan S, 2009 [23]	High	High	High	High	Low	Some concern	Low
Colado JC et al., 2009 [24]	Some concern	High	High	High	Low	Low	Some concern
Velthuis MJ et al., 2009 [25]	Low	Low	Low	High	Low	Low	Low
de Matos O et al., 2009 [26]	High	High	High	High	Low	Low	Low
Bocalini BC et al., 2009 [27]	Some concern	High	High	High	Low	Low	Low
Bolton KL et al., 2012 [28]	Low	High	Low	High	Low	Low	Low
Swift DL et al., 2012 [29]	Some concern	High	Low	High	Low	Low	Some concern
Moreira L et al., 2013 [30]	Low	High	High	Low	Low	Low	Some concern
Zaki ME, 2014 [31]	Some concern	High	High	High	Low	Low	Low
Neves LM et al., 2014 [32]	Some concern	Low	Low	Low	Low	Low	Some concern
Kemmler W et al., 2015 [33]	High	High	High	High	Low	Low	Low
Angin E et al., 2015 [34]	Some concern	High	High	High	Low	Low	Some concern
Borba-Pinheiro CJ et al., 2016 [35]	Some concern	High	Some concern	High	Low	Low	Some concern
Wen HJ et al., 2017 [36]	Some concern	High	High	High	Low	Low	Some concern
Watson SL et al., 2018 [37]	Low	High	High	Low	Low	Low	Low
Wochna K et al., 2019 [38]	High	High	High	High	Low	Low	Some concern
Hettchen M et al., 2021 [39]	Low	Low	High	Low	Low	Low	Low
Elavsky S and McAuley E, 2007 [40]	Low	High	High	Low	Low	Low	Low
Agil A et al., 2010 [41]	Some concern	High	High	High	Low	Low	Some concern
Bernard P et al., 2014 [42]	Low	High	Low	High	Low	Low	Low
Abedi P et al., 2015 [43]	Low	High	High	High	Low	Low	Some concern
Hu L et al., 2017 [44]	Some concern	High	High	High	Low	Low	Some concern
Takahashi M et al., 2019 [45]	Some concern	High	High	Low	Low	Low	Some concern
Aibar-Almazan A et al., 2019 [46]	Low	High	Low	Low	Low	Low	Some concern

[Table/Fig-4]: Risk of bias analysis [20-46].

overall health of postmenopausal women. Effects of higher levels of physical activity on anthropometric measures were recommended in a study by Swift DL et al., [29]. It is clear that volume of exercise protocol play a great role to evoke physiological response in measure of physical performance.

Seven studies investigated effects of physical activity on mental health in menopausal women. Most interestingly, raised daily levels of physical activity markedly increased blood Brain Derived Neurotrophic Factor (BDNF) levels in menopausal women, according to Takahashi M et al., [45]. Memory impairment and depression have been linked to BDNF, particularly in elderly persons [55]. According to prior research, regular exercise training and increased physical activity are strongly linked to a lower risk of depression and improved mental health [56]. A systematic review of the effects of physical activity on cancer patients indicated that even small amounts of walking and strengthening activities improve body fat, lean body mass, BMD, strength, walking distance, mental well being, mood and QOL. Different types of exercise have been found to increase positive affect and decrease negative affect in both healthy and unwell people, while the effects of aerobic exercise like walking have the most evidence [57,58]. Elavsky S and McAuley E and Hu L et al., found that walking and yoga are beneficial in improving mental health and QOL of postmenopausal women [40,44]. Aibar-Almazan

A et al., conducted a study on pilates exercise for the improvement of mental health parameters and discovered that a 12-week Pilates intervention improves sleep quality, anxiety, depression, and fatigue in postmenopausal women [46]. Various cross-sectional studies have found that physical activity had a favourable influence on menopausal symptoms, with active women reporting less or milder symptoms [59,60]. Prospective and longitudinal investigations, on the other hand, are still a mystery. Longer-duration physical activity interventions would also be preferable for eliciting more significant and long-lasting intervention benefits. Any physical activity intervention's success is also contingent on excellent programme adherence and low study attrition.

Risk of bias analysis using standard Cochrane tool showed that four trials were found to have a high risk of bias in the domain of random sequence creation, due to the lack of detailed randomisation methodologies. In the domain of allocation concealment, only three studies were found to have a low risk of bias. Blinding of participants and personnels was recorded in six research, while blinding of outcome assessors was indicated in eight studies. Almost all the studies provided complete outcome data. As a result, in future studies, allocation concealment, participant blinding, personnel blinding, and outcome assessor blinding should be prioritised in order to produce more accurate and reliable results.

Limitation(s)

It was found that many of the studies measured mental health characteristics based on self-reported methods. A limitation regarding present review was that only qualitative analysis of the included articles was done and limited outcome measures related to physical and mental health were taken. In future, it is recommended that impact of physical activity can be studied on various other measures of health and skill fitness such as cardiac fitness, balance, agility and coordination can also be analysed. Also, quantitative analysis can also be performed on different measures of physical and mental health.

CONCLUSION(S)

Menopausal symptoms affected a substantial percentage of postmenopausal women. Fatigue, hot flushes, back ache/joint pain, reduced BMI, and osteoporosis were the most prevalent menopausal problems mentioned by postmenopausal women. In addition, postmenopausal women experienced melancholy, anxiety, poor sleep, and anxiety. As a result, in addition to women in reproductive age, the policy makers may focus on providing health care to women in the postreproductive age group. This can be accomplished by including components pertaining to postmenopausal women's individual health requirements into national health programmes. For increased bone mineral density, a mixed exercise programme (resistance, aerobic/walking, Pilates) is recommended. To avoid fractures, these women should engage in workouts with prudence. As a result, it is strongly advised that these women follow an exercise programme provided by a specialist in the area, such as a physical education professional or a physiotherapist, after consulting with a physician.

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