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Gardening Activities and Physical Health Among Older Adults: A Review of the Evidence

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Abstract

Few studies have examined the health-related consequences of gardening among older adults. This scoping review summarizes and characterizes current research that examines the relationship between physical health and participation in planned gardening activities, including establishing, maintaining, or caring for plants. Six databases were searched. Eligible studies were published between 2000 and 2013, were published in English, and assessed different aspects of physical health (e.g., functional ability, energy expenditure, injury) for older adults who had participated in a planned gardening activity. Of the eight eligible studies identified with these criteria, four assessed energy expenditures and four assessed physical functioning. Studies assessing energy expenditures documented that the majority of gardening tasks were classified into low-to-moderate intensity physical activity. The current literature does not provide sufficient evidence of the physical functioning consequences of gardening. Future studies should consider how specific gardening interventions help older adults meet physical activity guidelines.

Keywords

physical activity; older adults; gardening tasks; programs

Introduction

Gardening has potentially strong physical health benefits for older adults. Older adults engage in gardening for numerous reasons, such as social, psychological, and personal enrichment as well as leisure-time physical activity (Ashton-Shaeffer & Constant, 2006). Studies on gardening among older adults typically examine benefits related to social and

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emotional health (e.g., Barnicle & Midden, 2003; Bertera, 2003; Lee, Lan, & Lee, 2012) rather than physical health. A more extensive body of research has examined physical health consequences of gardening interventions among children and non-senior adults. This literature typically finds gardening activities to have positive health-related consequences for these groups. Such benefits include improved diet and nutrition (Davis, Ventura, Cook, Gyllenhammer, & Gatto, 2011; Parmer, Salisbury-Glennon, Shannon, & Struempler, 2009; Wakefield, Yeudall, Taron, Reynolds, & Skinner, 2007), decreased diastolic blood pressure (Davis et al., 2011), greater physical activity (Wakefield et al., 2007), and reduced weight gain/body mass index (Davis et al., 2011). Prior reviews of gardening studies have not explicitly examined how specific gardening activities contribute to physical health of older adults (Wang & MacMillan, 2013). Regular physical activity provides older adults with numerous health benefits such as preventing or delaying the onset of chronic conditions and maintaining physical functioning (U.S. Department of Health and Human Services, 2008). Gardening is the second most commonly reported leisure-time physical activity among older adults, with walking being the most common (Ashe, Miller, Eng, & Noreau, 2008). Therefore, an assessment of the physical health benefits of gardening for older adults is needed.

The purpose of this review is to characterize studies of older adults engaging in planned gardening activities (i.e., physical tasks related to establishing, maintaining, or caring for plants). This review includes studies with gardening activities designed to promote physical health for older adults. In addition, gaps in the literature and recommendations for future studies are identified.

Method

This scoping review summarizes current research in this area and identifies research gaps (Arksey & O'Malley, 2005). As a result, studies were not excluded due to sample size or study design quality. A broad set of gardening studies were identified and reviewed to help ensure that relevant studies were captured (Figure 1).

The search strategy, key terms, abstraction process, and eligibility criteria are described in Figure 1. Planned gardening activities refer to any of the following: weeding, pruning, yard work, mowing, digging, harvesting flowers or vegetables, watering or potting plants, or arranging flowers. Studies that involved unplanned or passive activities (e.g., discussing or reading about gardening), used the garden as a setting for other activities (e.g., spending time in a park or garden), or examined agricultural work or farming as a profession were excluded. Studies had to meet the following criteria: included participants aged 65 or older or a sample with a mean age of 65 or older, assessed gardening activity at the individual level, included at least one reported physical health measure (e.g., functional ability, calories burned, body mass index, chronic disease onset or severity, injury, ergonomic issues, or mortality), and published in English between 2000 and 2013. Based on these criteria, eight eligible articles were included in this review.

Two authors (E.J.N. and L.A.A.) reviewed all eligible studies. Data were abstracted on the study characteristics (i.e., setting, study design, sample, and use of comparison group),

gardening activities (i.e., setting, intensity, and gardening tasks), and study outcomes (i.e., measures used to evaluate physical health consequences). Interpretation of study characteristics was consistent between participating authors; any differences in interpretation between the reviewers were resolved through discussion before study findings were summarized. The heterogeneity of physical health measures, study designs, and small sample sizes precluded use of quantitative methods such as meta-analysis. Therefore, this review provides narrative descriptions of eligible studies.

Results

The characteristics of the eight studies are presented in Table 1. Five of the studies were conducted in the United States, two in Korea, and one in China. All studies were made up of convenience samples drawn from community settings, senior centers, or nursing home facilities. The study designs included quasi-experimental with comparison group ($n = 2$), pre–post intervention with a cross-over design ($n = 1$), and observational studies ($n = 5$). Sample sizes ranged between 6 and 45 participants. The majority of participants were women. Four studies were conducted indoors, three outdoors, and one indoors and outdoors. The amount of time the participants were engaged in gardening varied by type of outcome. For studies examining exercise intensity, gardening activities ranged from 10 minutes to 2 hr per task. For studies examining physical functioning, gardening activities ranged from 20 min to 3 hr per task. Types and numbers of gardening tasks varied considerably, ranging from 3 to 32 gardening tasks (Table 1).

The four energy expenditures studies (Table 2) evaluated biometric measures of physical activity intensity during gardening tasks, primarily measured according to metabolic equivalent (MET). Energy expenditure varied according to the tasks completed, and most of the activities were considered low-to-moderate intensity (Knaggs, Larkin, & Manini, 2011; Park, Lee, & Son, 2011; Park, Lee, Son, & Shoemaker, 2012; Park, Shoemaker, & Haub, 2008). Certain tasks involved higher energy expenditure than others. Gardening tasks involving full-body movement tended to be more vigorous than those requiring upper- or lower-body only movement (Park et al., 2011; Park et al., 2012; Park et al., 2008).

The four functional health studies (Table 2) assessed functional status differently, including functional ability (Dartmouth Primary Care Cooperative Information Project, Minimum Data Set for Physical Functioning Scale, and Modified Barthel Index), observation of functional activities (transferring and walking), observation of body positions while gardening, and self-reported concerns (self-reported mobility impairments and self-reported pain while gardening). The majority of studies did not find that participation in planned gardening activities was associated with changes in functional status, with the exception of Brown, Allen, Dwozan, Mercer, and Warren (2004), who found that participation in a 5-week gardening program predicted superior performance compared with participants in a 2-week program. Among studies that examined the relationship between functional status and gardening, most (3 of 4) assessed participation in planned gardening activities involving exclusively container gardening. In terms of negative consequences, one study reported that gardening tasks were associated with low-to-moderate pain, particularly in the form of lower back pain during activities that involved bending (Park & Shoemaker, 2009).

Discussion

The findings from reviewed studies point to the importance of understanding the intensity and duration of planned gardening activities. The assessment of METs during specific gardening tasks provided investigators with matching intensity values for those activities. The results further indicated that the gardening tasks could be classified as low-to-moderate intensity physical activity. The relatively higher intensity activities were categorized "moderate intensity physical activity," requiring approximately 4.5 METs, whereas "lower intensity physical activity" required less than 3.0 METs (Pate et al., 1995). Three studies (Park et al., 2011; Park et al., 2012; Park et al., 2008) examined participant MET values for planned gardening activities that required full body use, upper body use, or limited body use, enabling assessment of activity intensity. Higher MET expenditure was recorded during full-body—as opposed to upper- or lower-body—gardening activities, which could explain why participants with mobility impairments expended fewer METs than those without mobility impairments (Knaggs et al., 2011). Investigators should strive to match a participant's physical capabilities with the desired duration of activities to promote physical health.

Studies that examined the relationship between gardening activities and functional health did not consistently find an effect on subsequent functional health/status among older adults. Improvements in functional limitations were found in only one study when comparing 2-week and 5-week activity programs (Brown et al., 2004). Among the studies focusing on the relationship between gardening activities and functional health, the intensity of the gardening tasks was not assessed. Like some other physical activity interventions (see Kruger, Buchner, & Prohaska, 2009), none of the gardening studies in this review attended to or reported on how the activities related to or met the physical activity guidelines for older adults (U.S. Department of Health and Human Services, 2008). Future studies should consider the duration and intensity of the gardening tasks, the appropriate group for the intervention (based on the participant's functional abilities and limitations), and the desired setting or nature of the intended intervention (beyond container gardening)

Based on this review, we identified two areas that merit further investigation. First, future studies should explore both positive and negative consequences of planned gardening activities. For example, Park and Shoemaker (2009) examined the consequences of gardening-related postures on functional health, finding that many (60%) participants reported low and moderate pain, particularly in the lower back, from bending. This is consistent with previous research examining predictors of back pain in the general population (Kopec, Sayre, & Esdaile, 2004) and studies evaluating ergonomic concerns of gardening and agricultural work using the Posture, Activities, Tools, and Handling (PATH) method. Second, there is a need for gardening activities that are explicitly designed to maximize physical health benefits for older adults with functional limitations. Thus, future research should examine the design and implementation of accessible gardens (Carman, 2006; Kearney & Winterbottom, 2005; Kwack, Relf, & Rudolph, 2005).

One additional recommendation is that future studies consider how to engage older adults and providers specializing in aging—such as geriatric social workers, nurses, geriatricians, and gerontologists—in the design of the intervention (e.g., EnhanceFitness: Belza,

Shumway-Cook, Phelan, Williams, & Snyder, 2006). None of the studies in this review included older adults as part of the planning or development of gardening activities. This is a potential shortcoming of current studies because when the intended audience contributes to how the study is designed and conducted, the interventions may have a higher likelihood of engagement and retention (Blair & Minkler, 2009). Furthermore, given the increasing diversity of the U.S. older adult population, future studies should include more diverse samples of older adults (Prohaska, Smith-Ray, & Glasgow, 2012).

This review had several strengths: The search was conducted by a professional librarian, and we focused on a specific set of planned gardening activities and physical health. However, several limitations should be noted. Study limitations included small sample sizes, convenience samples, and short assessment periods. Moreover, potential barriers to participation in gardening were not assessed. The review includes only published studies and the reported data were abstracted from the articles with no attempt to confirm the data with the authors. Furthermore, this scoping review intentionally included studies that assessed the relationship between gardening tasks and physical health in different settings. As a result, the heterogeneity of physical health measures and assessment methods precluded our performing a formal meta-analysis.

In conclusion, gardening is an active focus of investigation and there are known important social, psychological, and personal enrichment benefits. However, there is a need for more rigorous studies on the physical benefits of gardening. As part of future work, there is a need to align the gardening activities, including the intensity and duration, with specific physical health aspects of interest (e.g., physical functioning, energy expenditure). Interventions should be designed to address the physical activity needs of the diverse older population in the United States.

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Biographies

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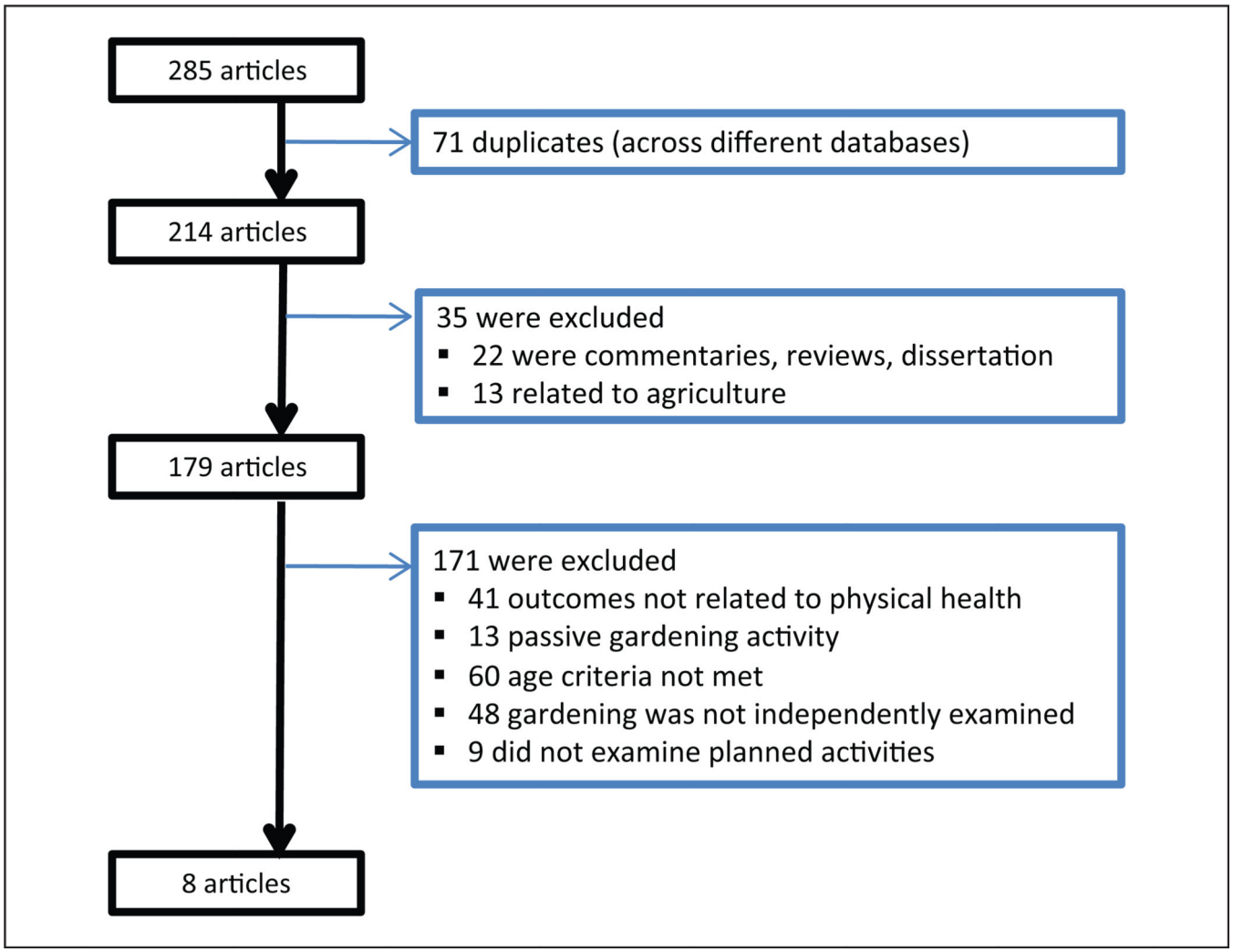

Figure 1.

Literature search strategy: Sources and exclusion criteria (published January 1, 2000 to April 8, 2013).

Source. CAB Abstracts, CINAHL, PsychInfo, PubMed plus reference lists of review articles. Key search terms for capturing active gardening included gardening (and gardens, garden, horticulture, or planting) and older adults (and aged, middle age, senior, seniors, elderly, elder, elders, middle-aged, geriatric, or geriatrics).

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Table 1

Characteristics of Studies Examining Active Gardening and Physical Health.

	Study and sample characteristics			Gardening strategy[a]	
			Physical functioning		
Author(s) (year)	Setting	Design	Sample	Location	Intensity/gardening tasks
Austin, Johnson, and Morgan (2006)	The United States; Convenience sample of senior center in Upstate NY	Pre-/post-assessment	Men (n = 2) Women (n = 4) M age: 68 years	Outdoor container gardening at a senior center	8 weeks; Based on health assessment; With therapist supervision, engaged in planned gardening activity directed at selected area for functional improvement
Brown, Allen, Dwozan, Mercer, and Warren (2004)	The United States; Convenience sample of senior center (Phase 1) and nursing home (Phase 2)	Quasi-experimental pre–posttest design (Phase 1); Cross-over design (Phase 2)	Men (n = 6 in Phase 1; n = 2 in Phase II) Women (n = 27 in Phase 1; n = 10 in Phase 2) M age: 81 years (Phase 1); M age: 82 years	An indoor gardening pilot project (5-week versus 2-week comparison)	5 weeks (Phase 1); 2 weeks (Phase 2); Decorating pots, planting bulbs, transplanting pants, arranging plants in baskets, arranging cut flowers
Park and Shoemaker (2009)	The United States; Convenience sample (of people who considered themselves gardeners)	Observational study	Men (n = 9) Women (n = 5) M age: 72 years	Participants' own gardens	1 day; 2 observation sessions for 17 gardening tasks[b] (each under 2 hr), which were performed by 90% of participants
Tse (2010)	Hong Kong, China; 4 randomly selected nursing homes	Quasi-experimental; Pre–posttest design	2 intervention nursing homes Men (n = 1) Women (n = 25) M age: 84 years; 2 control nursing homes Men (n = 7) Women (n = 20) M age: 83 years	Indoor gardening in recreation rooms	8 weeks; Functional ability was assessed during weekly visits; Tasks included gardening with soil, seeds, and tools, making natural pesticides, applying pesticides to plants, and positioning and watering plants
			Energy expenditure		
	Setting	Design	Sample	Setting	Intensity/gardening tasks
Knaggs, Larkin, and Manini (2011)	The United States; Convenience sample recruited through community	Observational study; Exclusions included numerous chronic conditions	Men (n = 20) Women (n = 25) M age: 76 years classified with (n = 14) and without (n = 31) mobility impairment[c]	Indoor; Gardening tasks were one of several physical tasks performed for approximately 10 min each	1 day; Tasks included filling pots, carrying pots, and placing pots on ground; Raking—rake paper into piles and place into box, which were performed for about 10 min.
Park, Lee, and Son (2011)	Gwanjin-gu, Seoul, South Korea; Convenience sample of adults aged 65&0x002B; were recruited from the community	Observational study	Men (n = 4) Women (n = 20) M age: 67 years	Outdoor gardening plots created for the study at Konkuk University	1 day; Metabolic characteristics were assessed 3–5 min following 15 different gardening activities that required using upper and lower body[d]

	Study and sample characteristics			Gardening strategy[a]	
Park, Lee, Son, and Shoemaker (2012)	Gwanjin-gu, Seoul, South Korea; Convenience sample from the community	Observational study	*N* = 17 (sex not given) *M* age: 67 years	Indoor and outdoor gardening activities conducted at Konkuk University	2 visits; Metabolic measurements were taken during 2 visits (25 and 40 min, respectively); During gardening tasks (propagating herbs, transplanting, and making a vegetable garden)
Park, Shoemaker, and Haub (2008)	The United States; Convenience sample of community-dwelling volunteers	Observational study	Men (*n* = 6) Women (*n* = 2) *M* age: 77 years	Outdoor garden plots created for the study	1 day; Metabolic measurements taken for nine observed gardening tasks[e], which were performed for about 10 min

[a] Behaviors involving the performance of physical activity related to establishing (e.g., digging, potting), maintaining (e.g., watering), or caring (e.g., pruning) for plants in indoor or outdoor environments.

[b] Weeding, walking, cleaning tools, hands, or produce, resting, carrying tools, storing tools or produce, harvesting, watering, gardening preparation, observing plants in the garden, cutting flowers or stems, pruning, mowing, deadheading, digging, mulching, planting plants.

[c] Difficulty walking, rising from chair, climbing flight of stars, or performing light housework.

[d] Weeding, digging, pruning, mixing soil, filling containers with soil, fertilizing, raking, planting transplants, tying plants to stakes, sowing seed, mulching, watering with can and hose, harvesting produce.

[e] Hand weeding, raking, digging, turning compost, transplanting plants, mulching, mixing soils, filling containers with soil, transplanting seedlings.

Table 2

Physical Functioning and Energy Expenditure.

Physical functioning		
Author(s) (year)	Measures	Key findings
Austin, Johnson, and Morgan (2006)	Functional health: Dartmouth Primary Care Cooperative Functional Health Assessment Charts Disability levels were assessed through self-reported mobility impairments	No statistically significant differences. No statistically significant differences.
Brown, Allen, Dwozan, Mercer, and Warren (2004)	Phase 1: Minimum Data Set for Physical Functioning Scale Phase 2: Functional health: Transferring and walking	No statistically significant differences. Significant differences between 2-week and 5-week program, with those in 5-week program performing better.
Park and Shoemaker (2009)	Primary positions were observed using an observational data sheet. Participants were asked, "Do you experience pain while gardening?" Response options included "always," "sometimes," or "never." Pain level was categorized as low, moderate, or high. Injuries were requested via an ad-hoc questionnaire	The following positions were observed to varying extents among participants during gardening activities: Gripping (88%), bending (82%), walking (59%), lifting (47%), stretching (29%), standing (6%). No participants reported injuries resulting from gardening. Almost 60% of participants did experience pain while gardening ("always": 7%, "sometimes": 50%, "never": 36%). Of those who reported pain, most reported it at a low (50%) to moderate (38%) level. Lower back pain (63%) was reported by most participants. Lower back pain was prevalent during bending activities.
Tse (2010)	Modified Barthel Index used to assess self-care functional ability of participants, testing 10 items	No significant changes in either group pre–post assessment.
Energy expenditure		
Author(s), year	Measures	Key findings
Knaggs, Larkin, and Manini (2011)	Energy expenditures were assessed in metabolic equivalents (METs) according to participant disability levels Disability levels were assessed through self-reported mobility impairments	Gardening activities consisted of filling ceramic pots from a soil basin, carrying the pots (weighing approximately 5 kg) across a room, placing pots on the ground, and planting plastic flowers. Observed average METs expenditure across the sample was (2.5 ± 0.7), significantly lower than estimated in previous literature (4.0). Compared with those without mobility impairments, participants with mobility impairments exerted 15% fewer METs while gardening.
Park, Lee, and Son (2011)	Exercise intensity was evaluated using MET values from a portable indirect calorimeter	Gardening tasks performed were of low to moderate intensity physical activity. Intensity of tasks were classified as follows: Moderate intensity tasks (3–4.5 METs) used both upper and lower body (e.g., digging, fertilizing, weeding, raking, tying plants to stakes). Low intensity (1.7–2.9 METs) tasks used the upper body while standing or squatting (e.g. pruning, mixing soil, planting seedlings, sowing, watering with can or hose, harvesting). The lowest intensity tasks (below 1.7 METs) required limited use of the upper body while standing (e.g., filling containers with soil, washing harvested produce).
Park, Lee, Son, and Shoemaker (2012)	Metabolic and heart rates were determined during each activity using a calorimetric instrument with a radiotelemetry monitor.	Activities were low to moderate in physical intensity for older Koreans. Propagating herbs and transplanting were low intensity physical activities (2.4 and 2.7 METs, respectively). Making a vegetable garden was a moderately intense physical activity (3.7 METs) for older adults. Less than 3 METs indicate low intensity, 3–6 METs are moderate, and above 6 METs are vigorous intensity ([Pate et al., 1995]).
Park, Shoemaker, and Haub (2008)	A submaximal graded exercise test was conducted to estimate V02, heart rate (% maximum heart rate), and METs	Tasks were low to moderate intensity physical activity (1.6–3.6 METs). Activities that worked the upper and lower body were moderate intensity physical activity while those that worked primarily the upper body were low intensity physical activity