

Appendix D - Description of the ageing studies, ordered by walking task.

Abbreviations: years old: y; male: m; female: f.

Shading:  not reported

Risk of bias:  Low,  Moderate,  Serious

Assessment of participant status:

- Fall history:
 - ✓ if fall history preceding the measurement was assessed
 - ✕ if fall history was assessed and fallers excluded from the study; in this case, we indicate the older adults as being at low fall risk.
- Physical/mental level:
 - ✓ if physical/mental level was tested
 - ✕ if physical/mental level was tested and subjects with low (respectively high) fitness were excluded from the study; in this case, we indicate the older adults as being at low (respectively high) risk.

Medicine usage






- ✓ if participants took medication during the measurement period
- ✕ if participants did not take medication during the measurement period

Measurement devices: if force platforms or infrared cameras were used, but their number was not reported, this is indicated by ✓

Task description: Expected:









- ✕ if unexpected changes in the task occurred from trial to trail (for example: if various obstacles or stairs were used and these were presented in random order, or if perturbations occurred at random times)
- ✓ otherwise










Article	Risk of bias	Assessment of participant status	Participants	Measurement devices	Task description








		Fall history (retrospective)	Physical level	Mental level	Community dwelling	Medicine usage	Younger adults	Older adults	Older adults at higher risk	Older adults at lower risk	Force platform	Infrared cameras system	Task	Expected	Self-selected walking velocity	Randomization or fatigue avoidance
Stairs																
Begg (2000)			✕ Questionnaire of musculoskeletal and visual impairments		✓		6 (21.2 ± 2 y) (All females)	6 (67.6 ± 4.8 y) (All females)				✓	Stepping onto raised surface Height: 15 cm Length: 500 cm Width: 100 cm	✓	Self-selected	✓
Bosse (2012)					✓		13 (25 ± 2 y) (6 m & 7 f)	13 (69 ± 4 y) (7 m 6 f)			3	13	Descent 2 steps, each Height: 17 cm Width: 30 cm	✓	Self-selected	
Chiu (2015)							20 (25 ± 4.5 y) (10 m & 10 f)	20 (74.3 ± 5.9 y, 10 m & 10 f)				12	Descent + ascent 4 steps, each Height: 17 cm Width: 28 cm	✓	Self-selected	
Christina (2002)			✓ Visual acuity			✕	12 (24 ± 3.3 y) (5 m & 7 f)	12 (73.3 ± 1.9 y) (8 m & 4 f)			2		Descent + ascent 7 steps, each Height: 18 cm Width: 28 cm	✓	Fixed velocity 0.65 m/s ± 0.04 m/s	✓
Crosbie (2003)			✓ Melbourne Edge test		✓		6 (21.9 y) (3 m & 3 f)	15 (73.1 y) (7 m & 8 f)				1	Stepping onto and off a raised surface	✓	Self-selected	✓

													Height: 9 cm Length: 35 cm Width: 100 cm		As fast as possible	
Dewolf (2021)		✓				8 (28.4 ± 5.2 y) (4 m & 4 f)				10 (73.5 ± 4.5 y) (9 m & 1 f)		9	Descent + ascent 2 steps, each Height: 13 cm Width: 24.5 cm	✓	Self-selected	✓
Dixon (2018)			✓ Timed-Up-and-Go			20 (24 ± 3 y)	19 (74.2 ± 6 y)				4	12	Descent + ascent 4 steps	✓		
Francksen (2022)						27 (24 ± 3 y)	33 (70 ± 4 y)				4	✓	Descent + ascent 7 steps, each Height: 20 cm Width: 24 to 26 cm	✗		✓
Francksen (2020)					✓	26 (24 ± 3y) No gender information	33 (70 ± 4y) No gender information				4	23	Descent + ascent 7 steps, each Height: 20 cm Width: 24 to 26 cm	✗		
Foster (2019)					✓	17 (25 ± 4 y) (10 m & 7 f)	15 (75 ± 3 y) (5 m & 10 f)				✓	10	Descent + ascent 4 steps	✓	Self-selected	
Hamel (2005)			✓ Visual acuity		✓	✗	12 (24.3 ± 2.5 y) (All females)	10 (73.5 ± 2.6 y) (All females)			✓		Descent + ascent 7 steps, each Height: 18 cm Width: 28 cm	✓	Fixed velocity 0.65 m/s ± 0.0325 m/s	
Hsue (2014)		✗			✓		28 (<40 y) (12 m & 16 f)			21 (>65 y) (10 m & 11 f)	2	8	Descent + ascent 5 steps, each Height: 18 cm Width: 28 cm	✓	Self-selected	✓
Hsue (2009)			✓				16 (28.7 ± 5.6 y)	10 (70.4 ± 4.4 y)			2	8	Descent + ascent 5 steps	✓	Self-selected	✓

			Physical activity questionnaire				(0 m & 16 f)	(0 m & 10 f)								
Kim (2009)	●	✓	✕ Berg Functional Balance Scale < 50 Frenchay Instrumental Activities of Daily Living score < 50 Physical Function score < 25 Visual acuity	✓ Mini mental status	✓		15 (23.6 ± 2.4 y) (5 m & 10 f)			15 (73.1 ± 4.3 y) (6 m & 9 f)	✓		Descent + ascent 3 steps, each Height: 17 cm Width: 28 cm	✓	Self-selected	
Larsen (2008)	●		✕ Physical activity questionnaire		✓		11 (25.8 ± 2 y)			19 (72.3 ± 6.6 y)	1		Descent + ascent 9 steps, each Height: 16 cm Width: 23 cm	✓	Self-selected	
Mian (2007)	●		✓ Physical activity questionnaire Short physical performance battery Timed-Up-and-Go	✓ Falls efficacy scale	✓		13 (28 ± 4 y) (13 m & 0 f)	15 (76 ± 3 y) (15 m & 0 f)			✓	9	Descent + ascent 3 steps, each Height: 16.5 cm Width: 28 cm	✓	90-95 steps/min	
Novak (2011)	●	✕			✓		24 (23.7 ± 3.0 y) (7 m & 17 f)			33 (67.0 ± 8.2 y) (14 m & 19 f)	1	2	Descent + ascent 4 steps, each Height: 15 cm Width: 26 cm	✓	Self-selected	✓
Novak (2016)	●				✓		14 (25.5 ± 3.2 y) (8 m & 6 f)	14 (73.1 ± 6 y) (7 m & 7 f)				3	Descent + ascent 6 steps, each Height: 7 to 8 inches Width: 8 to 14 inches	✕	Self-selected	✓




Reeves (2009)							17 (24.6 ± 4.1 y) (10 m & 7 f)	15 (74.8 ± 2.8 y) (5 m & 10 f)			2	9	Ascent 4 steps, each Height: 17 cm Width: 28 cm	✓	Self- selected	
Perturbations																
Afschrift (2019)		✓					18 (21 ± 2 y)			10 (71 ± 4 y)	✓	12	Anteroposterior and mediolateral support translation	✕	1.1 m/s	✓
Bosquée (2021)							12 (24 ± 3 y)	11 (72 ± 5 y)			1		Backward ankle pull	✕	Self- selected	✓
Debelle (2021)							17 (25.2 ± 3.7 y) (8 m & 9 f)	17 (62.4 ± 6.6 y) (3 m & 14 f)			✓	12	Backward support acceleration at 5 m/s ²	✕	Fixed velocity 1.2 m/s	✓
Jeon (2022a)				✕ Mini mental status < 26			10 (28.2 ± 4.8 y) (4 m & 6 f)	10 (62.5 ± 4.7 y) (7 m & 3 f)				8	Anteroposterior support acceleration at 7.75 m/s ² , 12 m/s ² , 16.75 m/s ²	✕	Self- selected	✓
Jeon (2022b)							10 (24 ± 3 y) (4 m & 6 f)			10 (77 ± 8 y) (5 m & 5 f)		10	8 cm surface drop	✕	Self- selected	
Kazanski (2020)			✓ Timed-Up-and-Go Square Step Test	✓ Mini mental status examination 10-point abbreviated Iconographic-Falls Efficacy Scale			17 (23.7 ± 3.7 y) (8m & 9 f)	17 (67.5 ± 4.9 y) (7m & 10 f)				10	Mediolateral support or visual field translation	✓	Self- selected	✓
Laudani (2021)			✕ Physical activity questionnaire (exclude highly active individuals) ✓ Berg Balance Scale		✓		10 (25 ± 2 y) (2 m & 8 f)		10 (73 ± 5 y) (2 m & 8 f)		2	13	Mediolateral waist-pull at 10% of the body mass	✕	Self- selected	✓

Liu (2009)					✓		9 (23.6 ± 4.8 y)	9 (73.6 ± 4.4 y)			2	6	One of the force plates was covered in soapy water	✕		
Martelli (2017)		✕				✕	8 (24 ± 2.7 y) (4 m & 4 f)			8 (65 ± 4.8 y) (5 m & 3 f)		6	Forward support acceleration at 0.89 m/s ² , 1.26 m/s ² , 1.54 m/s ²	✕	Fixed velocity $V = \sqrt{Fr} * g * L$, Fr = 0.15	✓
McCrum (2016)							11 (25.5 ± 2.1 y) (0 m & 11 f)	14 (69.0 ± 4.7 y) (0 m & 14 f)				8	Backward ankle pull of 2.1 kg	✕	1.4 m/s	
McIntosh (2016)			✓ Berg Balance Scale		✓		11 (23.8 ± 3.1 y) (4 m & 7 f)	10 (71.1 ± 3.1 y) (2 m & 8 f)				✓	Forward support translation of 16 cm at 130 cm/s ² acceleration	✕	Self-selected	✓
Nachmani (2020)				✓ Mini mental status	✓		19 (26 ± 0.8 y) No gender information	35 (81 ± 4.5 y) No gender information				2	Medial-lateral support translation	✕	Self-selected	✓
Qiao (2018)		✕	✕ Health questionnaire BMI > 30				11 (24.8 ± 3.4 y) (5 m & 6 f)			11 (75.3 ± 5.4 y) (5 m & 6 f)		14	Mediolateral visual field translation	✕	Self-selected	✓
Ren (2022)		✕	✓ Timed-Up-and-Go				15 (26.5 ± 3 y)			15 (68.3 ± 3.3 y)	2	10	Anteroposterior support acceleration at 3 m/s ²	✕	Self-selected	✓
Roeles (2018)			✓ 20 minute walking test		✓		9 (25.1 ± 3.4 y) (6 m & 3 f)	9 (70.1 ± 8.1 y) (2 m & 7 f)				32	Mediolateral or anteroposterior support translations, or room darkening	✕	Self-selected	✓
Rum (2020)			✓ Berg Balance Scale	✓ Falls Efficacy Scale-International	✓	✕	10 (25 ± 2 y) (2 m & 8 f)	10 (73 ± 5y) (2 m & 8 f)			2	13	Mediolateral waist-pull at 10% of the body mass	✕	Self-selected	✓

Shulman (2018)			✓ Waterloo Footedness questionnaire		✓		18 (21.7 ± 2.6 y) (10 m & 8 f)	16 (75.6 ± 5.3 y) (9m & 7f)			2	12	Medial-lateral support translation at 60 cm/s, 2 m/s ²	✕		✓
Shulman (2019)					✓		18 (21.7 ± 2.6 y) (10 m & 8 f)	16 (75.6 ± 5.3 y) (9 m & 7 f)			2	12	Anterior-posterior support translation at 60 cm/s, 2 m/s ²	✕		✓
Tropea (2015)							6 (24 ± 1.7 y) (4 m & 2 f)	6 (66.7 ± 5.4 y) (2 m & 4 f)			✓	✓	Forward support translation at 8 m/s ²	✕	Fixed velocity $V = \sqrt{Fr} * g * L$, Fr = 0.15	
Yoo (2021)				✓ Montreal Cognitive Assessment			14 (23.4 ± 2.9 y) (7 m & 7 f)	14 (70.9 ± 4.5 y) (4 m & 10 f)			2	12	10 m/s ² forward support translation (split-belt treadmill)	✕	Self-selected	✓
Obstacles																
Caetano (2016)			✓ Melbourne Edge Test Physiological Performance Assessment Trail Making Test	✓ Montreal Cognitive Assessment Iconographical-Fall Efficacy Scale	✓		21 (26 ± 4 y) (9 m & 12 f)			50 (74 ± 7 y) (16 m & 34 f)	✓		Visually projected obstacle Height: 0 Length: between 1/3 of step length and 21.5 cm Width: < 21.5 cm	✓	Self-selected	✓
Chen (1991)		✓	✓ Visual acuity, osteoarthritic symptoms, hearing loss, lower extremity weakness and reflexes, vibration sense	✓ Mini mental status	✓		24 (21.7 ± 2.1 y) (12 m & 12 f)			24 (71.2 ± 5.5 y) (12 m & 12 f)		4	Height: 2.5, 5.1, 15.2 cm	✓	Self-selected	✓
Chen (1994)			✓ Visual acuity, pain or numbness, hearing loss,		✓	✕	24 (23.7 ± 2.1 y) (12 m & 12 f)	24 (73 ± 5.5 y) (12 m & 12 f)				✓	Visually projected obstacle	✓	Self-selected	✓

			vibratory sense, lower extremity reflexes										Height: 0 Length: 3 cm Width: 70 cm			
Chien (2018)	●	✕			✓		10 (28.1 ± 1 y) (4 m & 6 f)			10 (66.7 ± 5.21 y) (3 m & 7 f)		8	Height: 10 % of leg length Length: 2 cm Width: 60 cm	✓	Self-selected	✓
Draganich (2004)	●						10 (25.9 y) (5 m & 5 f)	10 (71.6 y) (7 m & 3 f)			1	✓	Height: 20 cm Length: 0.5 cm Width: 90 cm	✓	Self-selected <0.85 m/s <1.2 m/s	✓
Eyal (2020)	●	✕	✓ Four step square test Mini balance evaluation system Timed-Up-and-Go	✓ Montreal cognitive assessment Color trails test			20 (20-35 y) (10 m & 10 f)			20 (70-85 y) (10 m & 10 f)			Height: 0.20, 0.5, 0.75, 1, 1.25 cm Length: 20 cm Width: 60 cm	✕	Self-selected	✓
Hahn (2004)	●		✓ Berg Balance Scale	✓ Mini mental status	✓		13 (25.7 ± 3.6 y) (7 m & 6 f)	13 (72.8 ± 6 y) (8 m & 5 f)				6	Height: 2.5 %, 5%, 10%, 15% of body height	✓	Self-selected	✓
Huang (2008)	●						10 (26.1 ± 2.5 y)	15 (72 ± 6 y)			2	7	Height: 10 %, 20%, 30% of leg length	✓	Self-selected	
Kim (2013)	●	✓	✓ Berg Balance Scale Frenchay Activities Index Physical Functioning score Health Surveys	✓ Mini mental status	✓	✕	9 (27 ± 3.6 y) (4 m & 5 f)			9 (75.1 ± 6.7y) (4 m & 5 f)	2		Height: 10 cm	✓	Self-selected	✓
Kulkarni (2021)	●						17 (20.9 ± 1.9 y) (3 m & 14 f)	14 (69.7 ± 5.4y) (4 m & 10 f)				✓	Height: 23.5 cm Length: 0.8 cm Width: 100 cm	✓	Self-selected	
LoJacono (2018)	●		✓ Physical activity questionnaire				20 (22.5 ± 3.7 y)	20 (55.6 ± 6 y)				12	Height: 0.5 cm Length: 10 cm Width: 100 cm	✓	Self-selected	✓
Lowrey (2007)	●			✓ Mini mental status	✓	✕	8 (23.1 ± 2 y) (4 m & 4 f)	8 (76.1 ± 4.3 y) (4 m & 4 f)				✓	Height: 45% of lower leg length	✓	Self-selected	✓

													Length: 2.5 or 5 cm (unclear)			
Lu (2006)	●						15 (23 ± 3 y) No gender information	15 (72 ± 6 y) No gender information			2	7	Height: 10%, 20% and 30% of leg length	✓	Self- selected	
Luo (2022)	●	✕			✓		11 (27 ± 3 y) (All males)			7 (67.5 ± 2.5 y) (All males)		✓	Height: 14 cm	✓	Self- selected	✓
Maidan (2018)	●		✓ Montreal cognitive assessment Trail making test Four square step test Timed-Up-and-Go	✕ Mini mental status < 24	✓		20 (29.3 ± 8.8 y) (10 m & 10 f)	20 (77.7 ± 3.5 y) (10 m & 10 f)				✓	Height: 2.5, 7.5 cm Length: 20 cm Width: 60 cm	✕	Self- selected	✓
McFadyen (2002)	●		✓ Foot vibration Ostwestry back-pain questionnaire		✓		10 (28.4 ± 5.4 y) (All males)	10 (69.5 ± 6.1 y) (All males)			2	✓	Height: 5 cm Length: 11.75 cm Width: 122 cm	✓	Self- selected	✓
Mckenzie (2004)	●	✓	✓ Standard sensorimotor tests	✓ Mini mental status			15 (22.5 ± 2.77 y) (5 m & 10 f)			17 (68.94 ± 4.85 y) (7 m & 10 f)		6	Height: 15 cm Width: 60, 15 cm	✓	Self- selected	✓
Park (2012)	●		✓ Berg Balance Scale	✓ Mini mental status			9 (25.8 ± 2.8 y) (3 m & 6 f)	9 (69.7 ± 3.9 y) (3 m & 6 f)				6	Height: 10%, 20%, 30% of leg length Width: 100 cm	✓	Self- selected	✓
Tomar (2012)	●		✓ Berg Balance Scale Trail-making test Timed-Up-and-Go Choice stepping reaction time	✓ Mini mental status			30 (18-30 y) (All males)	30 (>65 y) (All males)				1	Height: 7.6, 12.7, 20.3 cm Length: 12.7 cm Width: 25.4 cm	✓	Self- selected	
Uchiyama (2012)	●		✓ Berg Balance Scale				17 (21 ± 2.4 y)	30 (70 ± 6.9 y)					Height: 5 cm Length: 10 cm Width: 120 cm	✓	Self- selected	✓

Wang (2010)			✓ Snellen vision test			✕	15 (23 ± 3 y) (8 m & 7 f)	15 (72 ± 6 y) (8 m & 7 f)			2	7	Height: 10%, 20% and 30% of leg length	✓	Self- selected	
Weerdesteyn (2005a)		✓					25 (20-37 y) (4 m & 21 f)		99 (65-88 y) (22 m & 77 f) Only subjects with fall history were included			✓	Height: 1.5 cm Length: 30 cm Width: 40 cm	✕	Fixed velocity 0.83 m/s	✓
Weerdesteyn (2005b)			Recruited from elderly sports groups				10 (19-32 y) (0 m & 10 f)			10 (65-78 y) (0 m & 10 f)		6	Height: 1.5 cm Length: 30 cm Width: 40 cm	✕	Self- selected	✓