

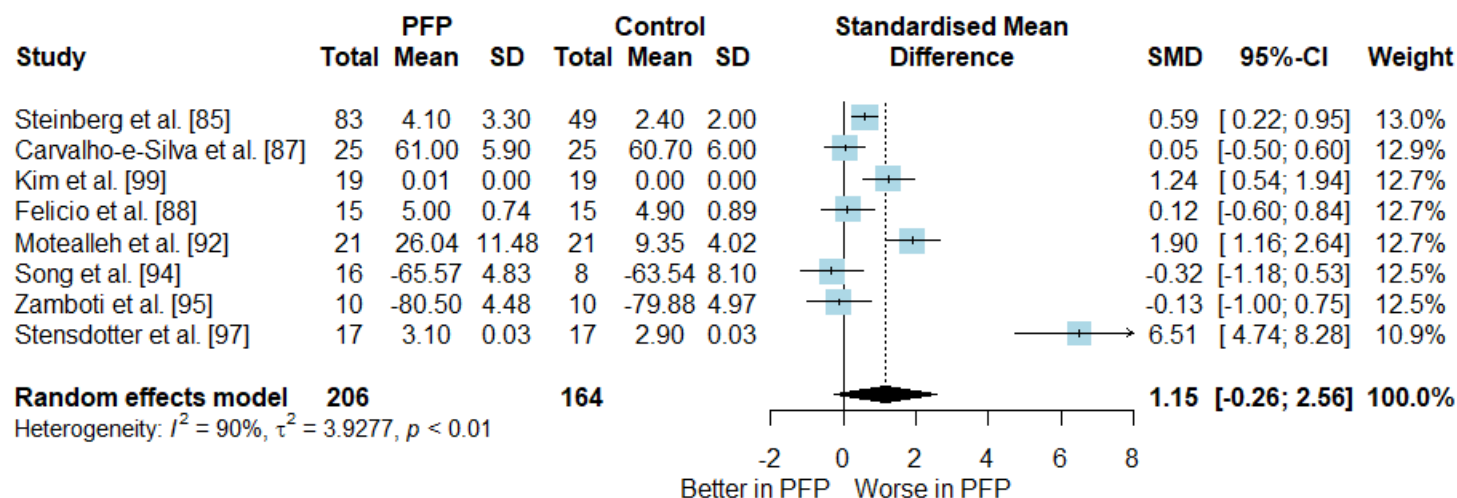
Additional file 7A. Results for Subgroup and Meta-regression analyses for Q1 (PFP vs Controls for balance impairments).

	Analysis	n PFP/ Control	SMD (95% CI)	p-value	I ²	Level of Evidence
	AP postural stability; 19 studies	448/407	1.03 (0.40 to 1.66)	<0.001	86%	⊕⊕⊕⊕ Very Low
Subgroup analyses	<i>by sex</i>					
	Females; 8 studies	206/164	1.15 (−0.26 to 2.56)	0.110	90%	⊕⊕⊕⊕ Moderate
	Mixed; 10 studies	212/213	0.94 (0.27 to 1.60)	0.001	83%	⊕⊕⊕⊕ Very Low
	<i>by assessment method</i>					
	SEBT Anterior; 8 studies	230/170	1.08 (0.21 to 1.96)	0.015	85%	⊕⊕⊕⊕ Moderate
	Posturography; 4 studies	79/79	0.85 (0.37 to 1.32)	<0.001	49%	⊕⊕⊕⊕ Moderate
	CoP; 7 studies	139/158	1.19 (−0.44 to 2.83)	0.153	92%	⊕⊕⊕⊕ Low
	<i>by task</i>					
	Dynamic; 14 studies	351/291	1.26 (0.41 to 2.11)	0.004	87%	⊕⊕⊕⊕ Very Low
	Static; 5 studies	97/116	0.48 (−0.26 to 1.22)	0.206	83%	⊕⊕⊕⊕ Low
	Meta-regression (age) = B=0.01, 95% CI −0.10 to 0.12; p=0.90; R ² =0%; I ² =86%					
	ML postural stability; 13 studies	261/279	0.87 (0.31 to 1.42)	0.002	85%	⊕⊕⊕⊕ Moderate
Subgroup analyses	<i>by sex</i>					
	Females; 5 studies	100/99	0.88 (−0.18 to 1.93)	0.102	91%	⊕⊕⊕⊕ Low
	Mixed; 7 studies	131/150	0.83 (0.03 to 1.63)	0.042	79%	⊕⊕⊕⊕ Low
	<i>by assessment method</i>					
	Posturography; 4 studies	79/79	0.42 (−0.25 to 1.10)	0.222	78%	⊕⊕⊕⊕ Low
	CoP; 8 studies	172/190	0.84 (0.21 to 1.46)	0.009	86%	⊕⊕⊕⊕ Moderate
	<i>by task</i>					
	Dynamic; 9 studies	182/200	0.92 (0.13 to 1.71)	0.022	88%	⊕⊕⊕⊕ Moderate
	Static; 4 studies	79/79	0.81 (0.02 to 1.59)	0.044	80%	⊕⊕⊕⊕ Low
	Meta-regression (age) = B=0.01, 95% CI −0.20 to 0.21; p=0.97; R ² =0%; I ² =84%					
	Overall postural stability; 15 studies	354/335	0.38 (−0.05 to 0.82)	0.083	84%	⊕⊕⊕⊕ Moderate
Subgroup analyses	<i>by sex</i>					
	Females; 10 studies	218/199	0.31 (−0.33 to 0.96)	0.341	89%	⊕⊕⊕⊕ Moderate
	Mixed; 4 studies	106/106	0.30 (0.03 to 0.57)	0.032	0%	⊕⊕⊕⊕ High
	<i>by assessment method</i>					
	SEBT; 2 studies	103/88	0.51 (0.06 to 0.96)	0.027	58%	⊕⊕⊕⊕ Low
	Posturography; 5 studies	101/101	0.47 (0.01 to 0.93)	0.048	63%	⊕⊕⊕⊕ Moderate
	CoP; 8 studies	150/146	0.29 (−0.51 to 1.10)	0.475	91%	⊕⊕⊕⊕ Moderate
	<i>by task</i>					
	Dynamic; 10 studies	258/239	0.30 (−0.27 to 0.86)	0.301	87%	⊕⊕⊕⊕ Moderate
	Static; 5 studies	96/96	0.55 (−0.14 to 1.25)	0.119	79%	⊕⊕⊕⊕ Low
	Meta-regression (age) = B=0.02, 95% CI −0.08 to 0.11; p=0.70; R ² =0%; I ² =86%					

Abbreviations: AP = anteroposterior; CoP = centre of pressure; ML = mediolateral; PFP = patellofemoral pain; SEBT = Star Excursion Balance Test; SMD = standardised mean difference.

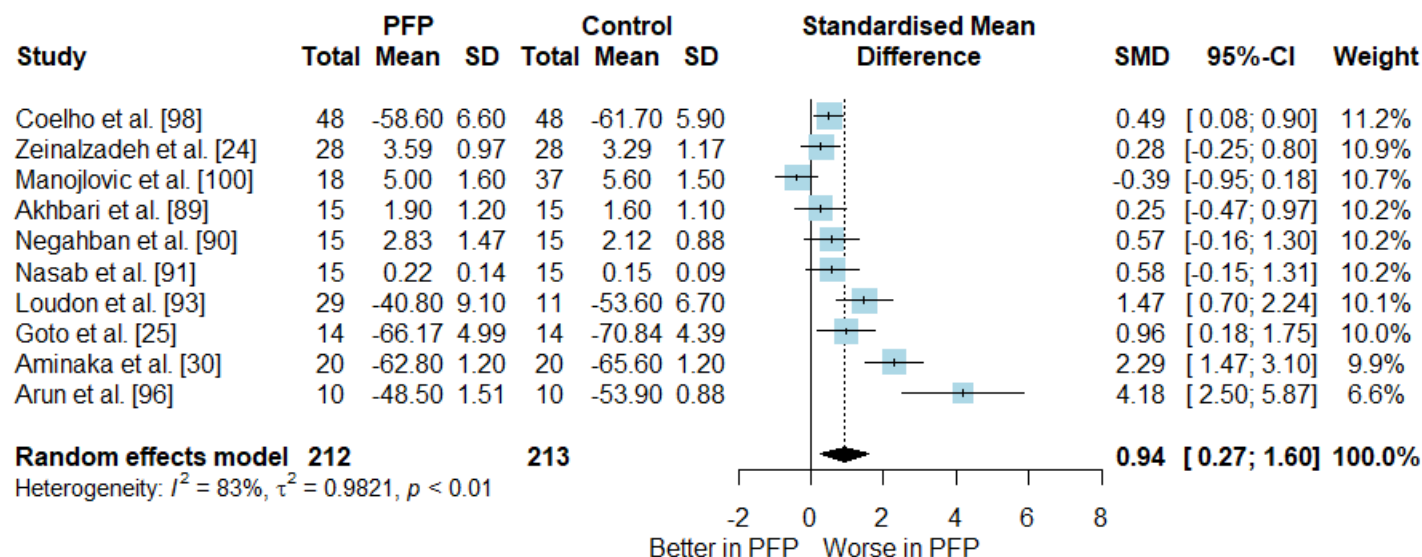
- Balance for AP postural stability

Subgroup analysis: females



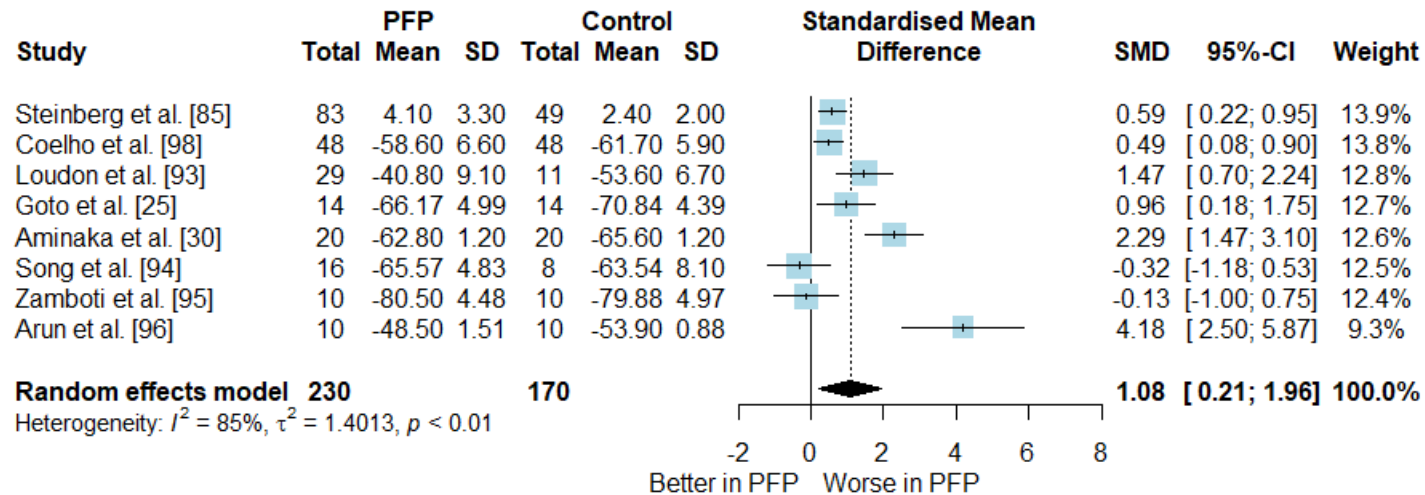
- Balance for AP postural stability

Subgroup analysis: mixed-sex



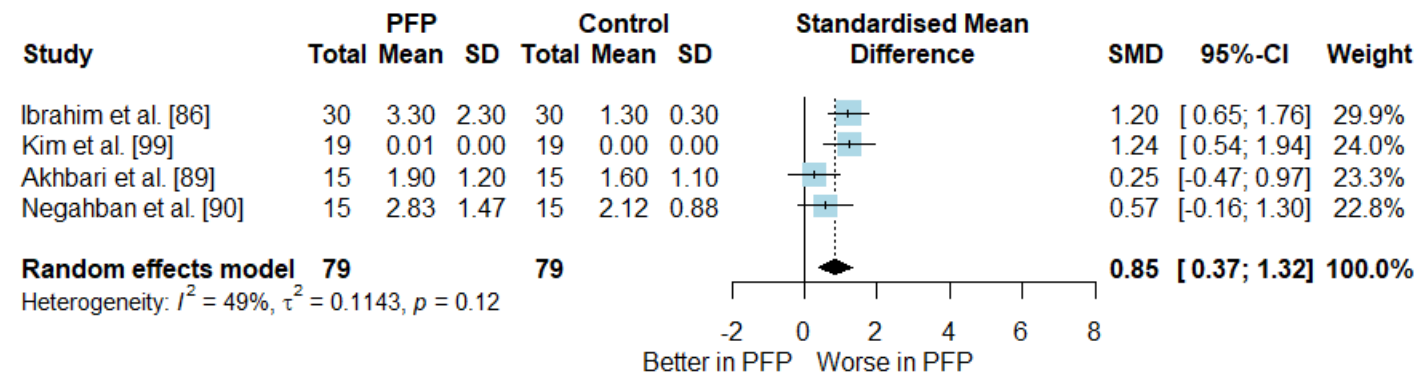
- Balance for AP postural stability

Subgroup analysis: Star Excursion Balance Test Anterior Direction



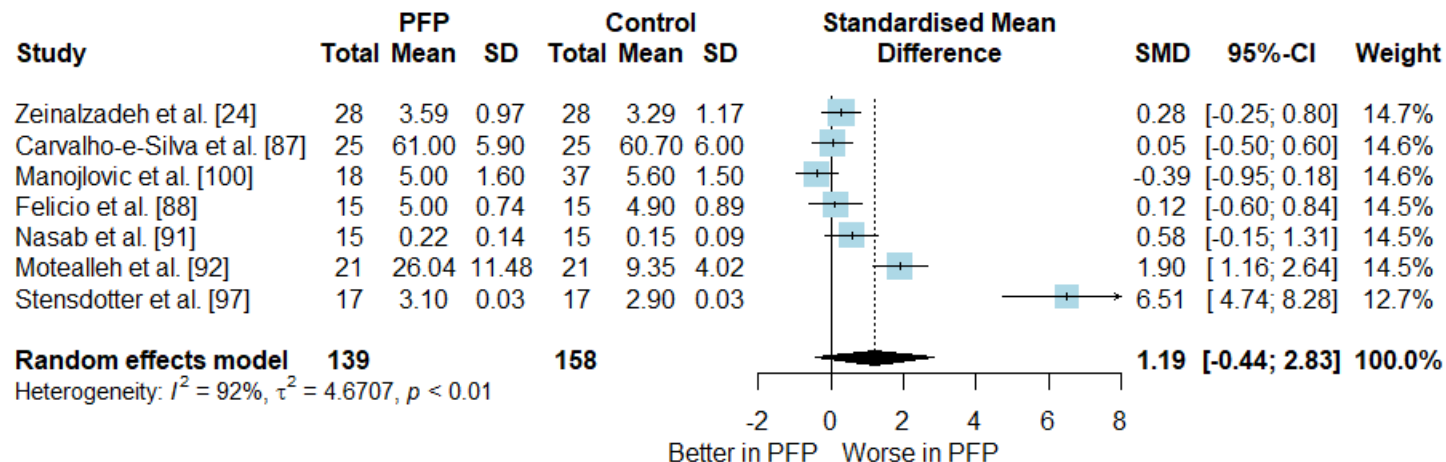
- Balance for AP postural stability

Subgroup analysis: Posturography



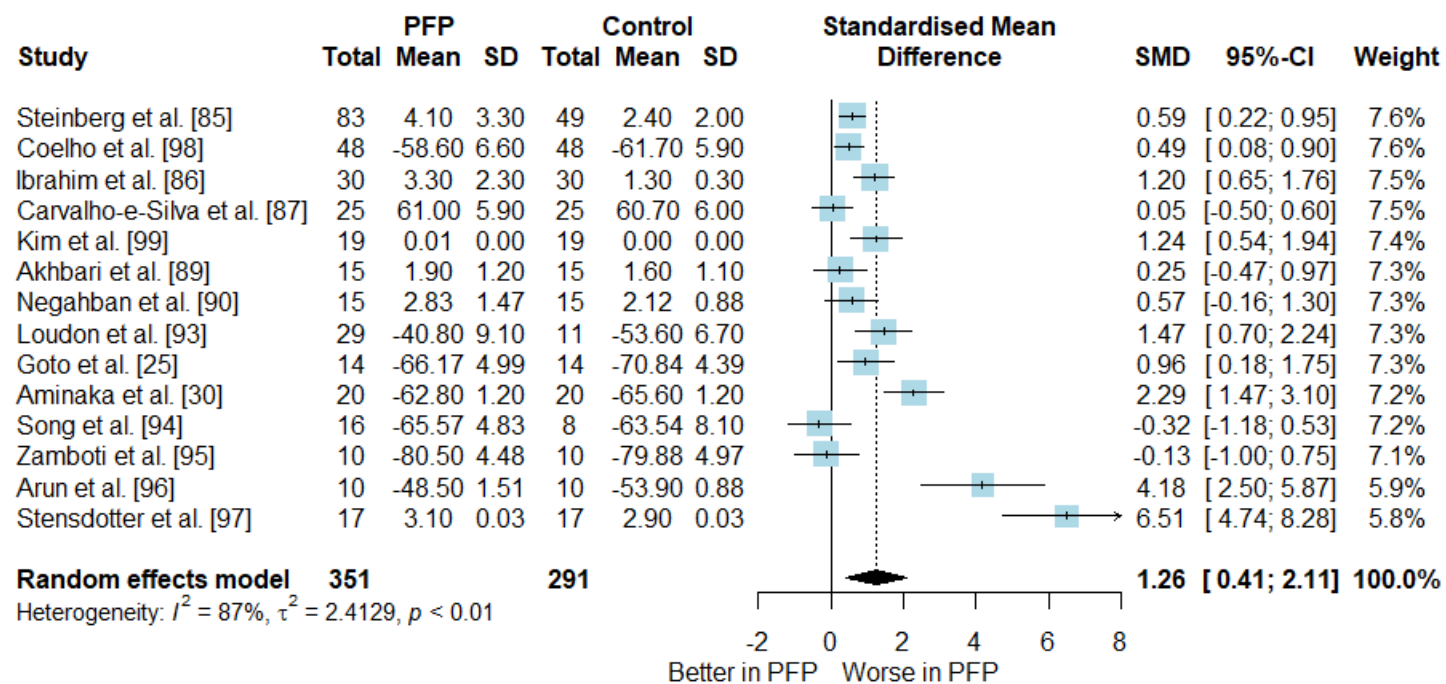
- Balance for AP postural stability

Subgroup analysis: Centre of Pressure Behavior



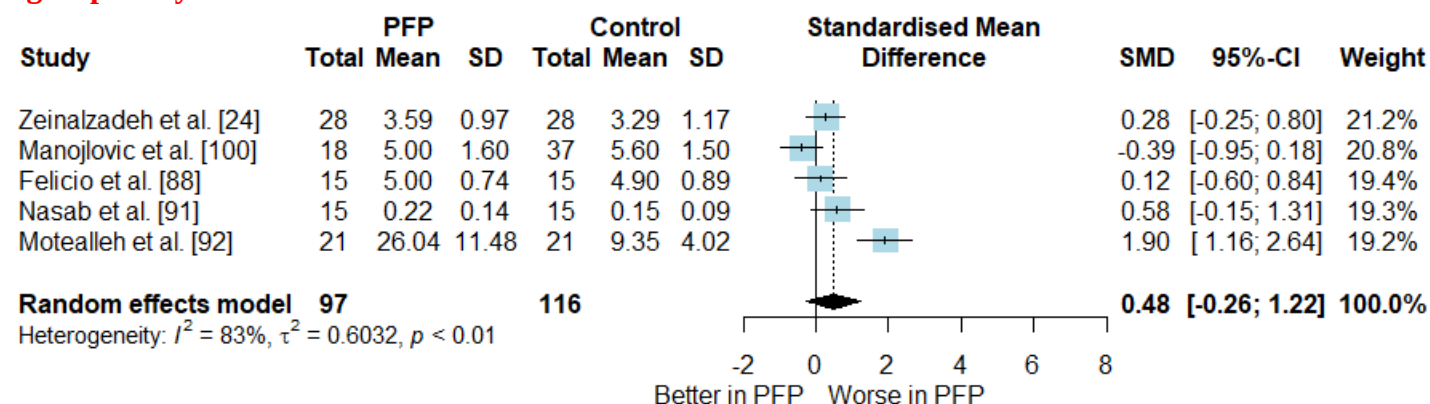
- Balance for AP postural stability

Subgroup analysis: Dynamic measures



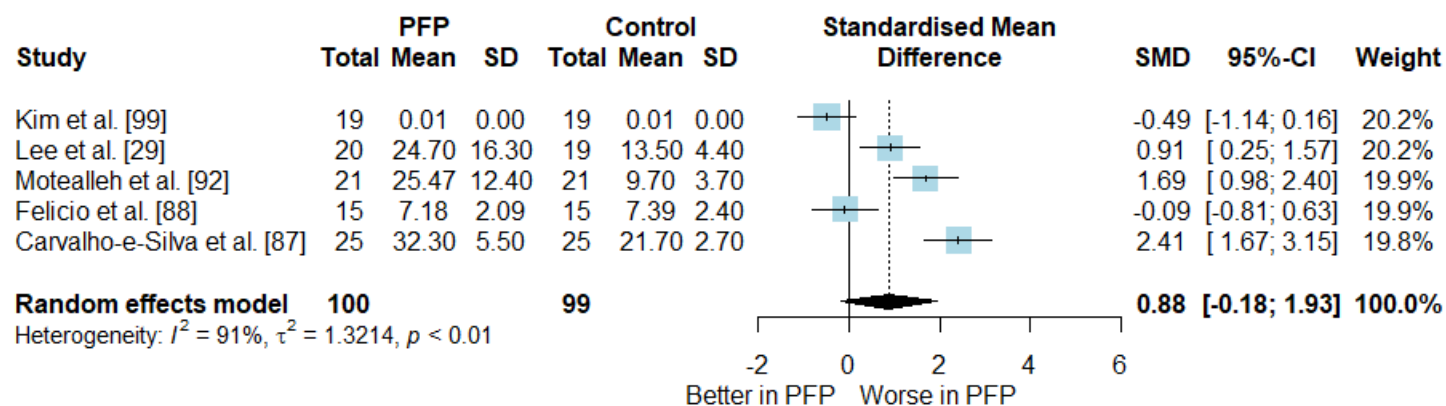
- Balance for AP postural stability

Subgroup analysis: Static measures



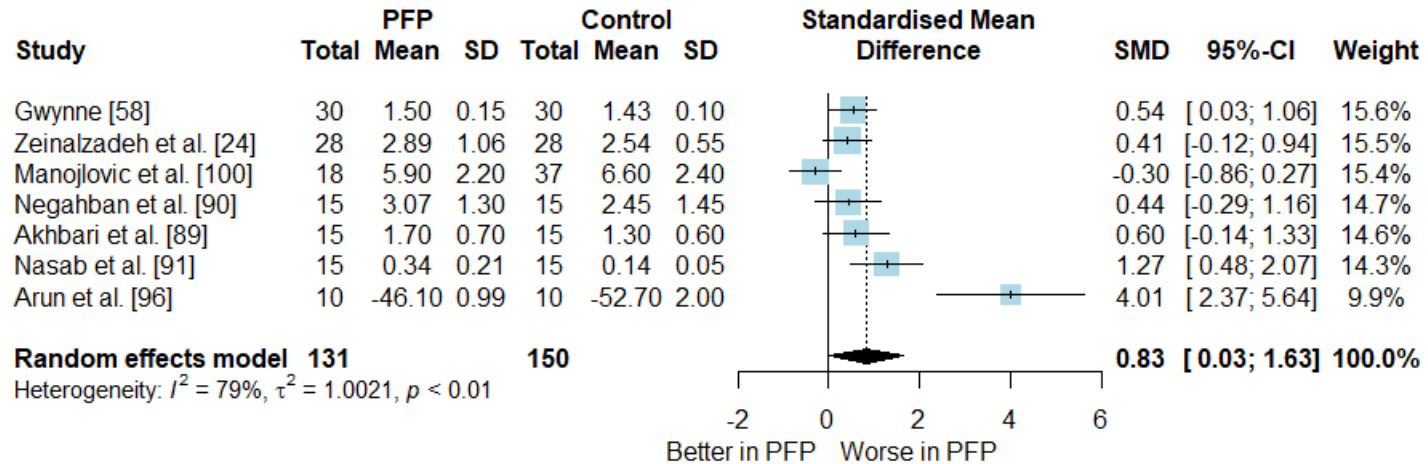
- Balance for ML postural stability

Subgroup analysis: females



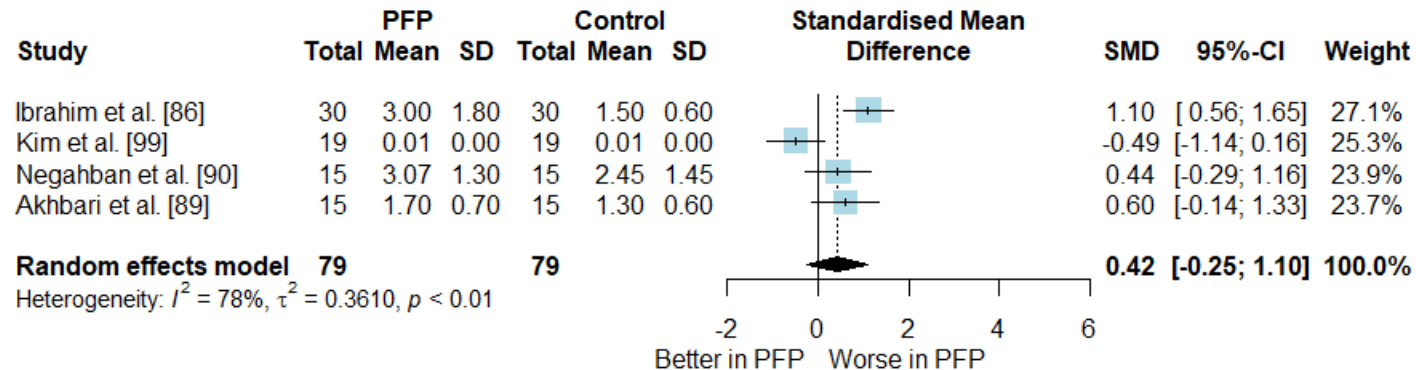
- Balance for ML postural stability

Subgroup analysis: mixed-sex



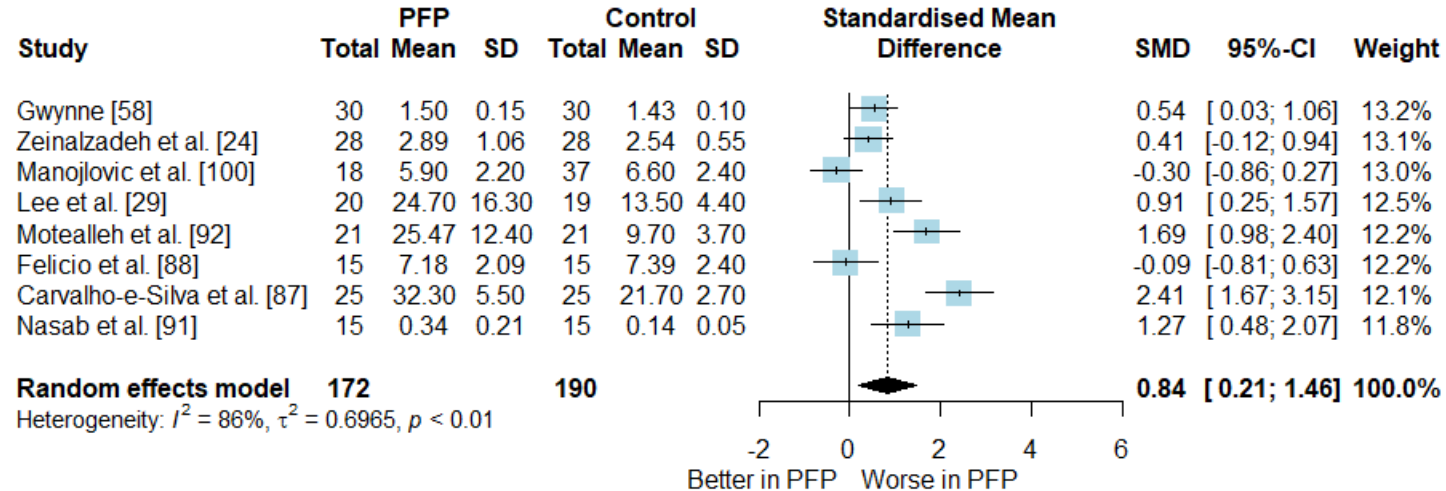
- Balance for ML postural stability

Subgroup analysis: Posturography



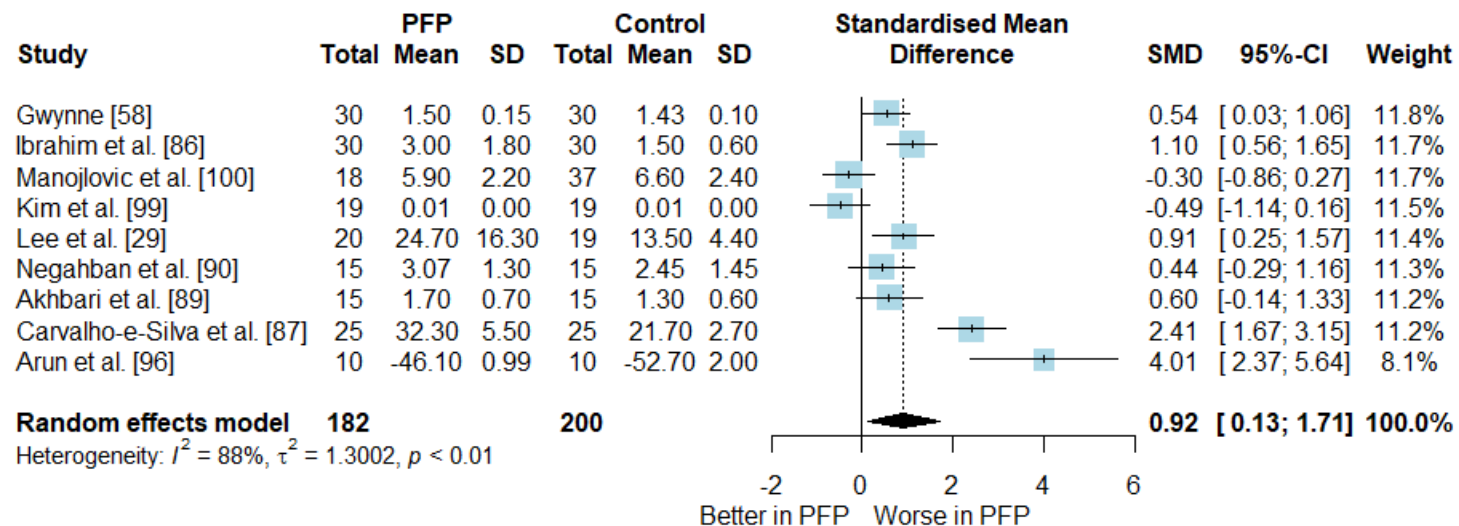
- Balance for ML postural stability

Subgroup analysis: Centre of Pressure Behavior



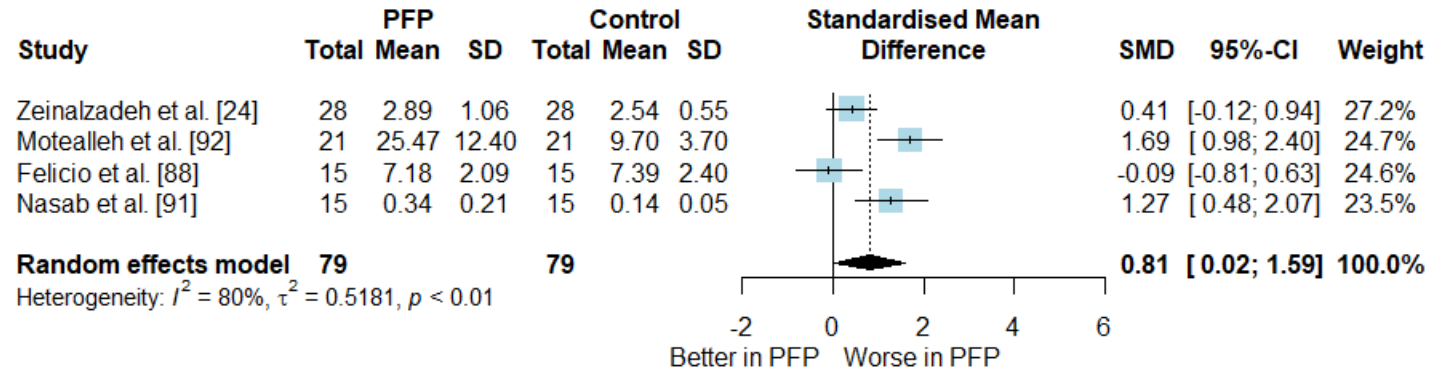
- Balance for ML postural stability

Subgroup analysis: Dynamic measures



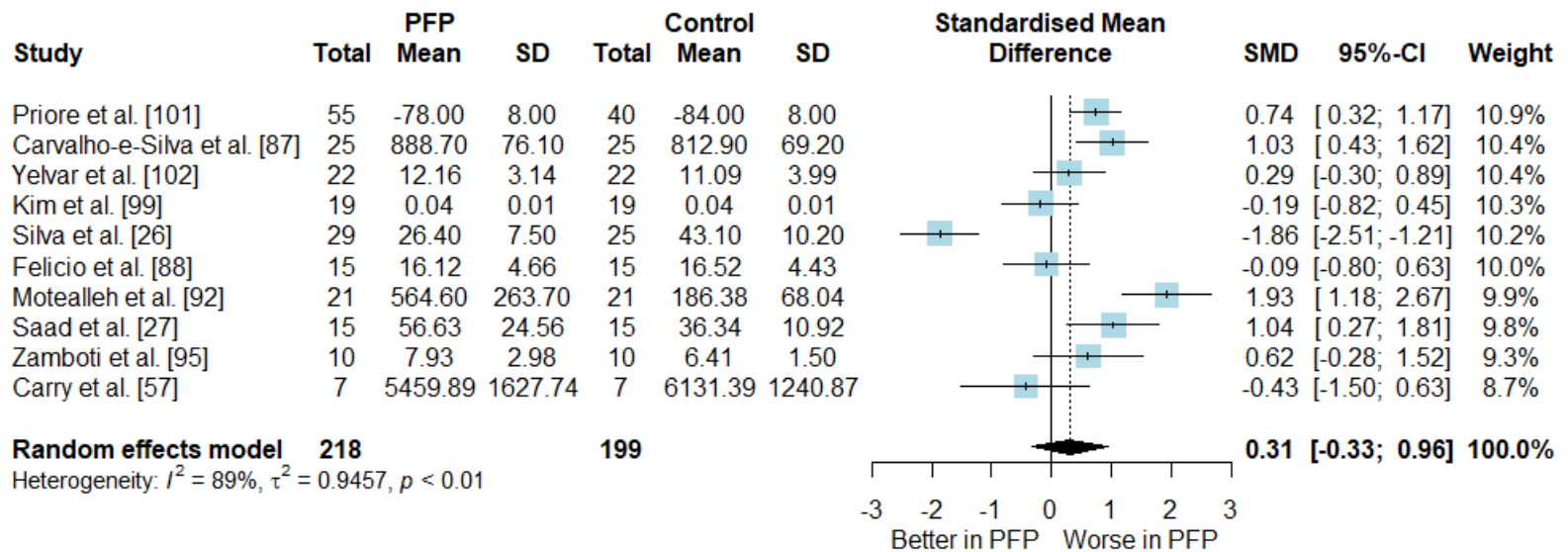
- Balance for ML postural stability

Subgroup analysis: Static measures



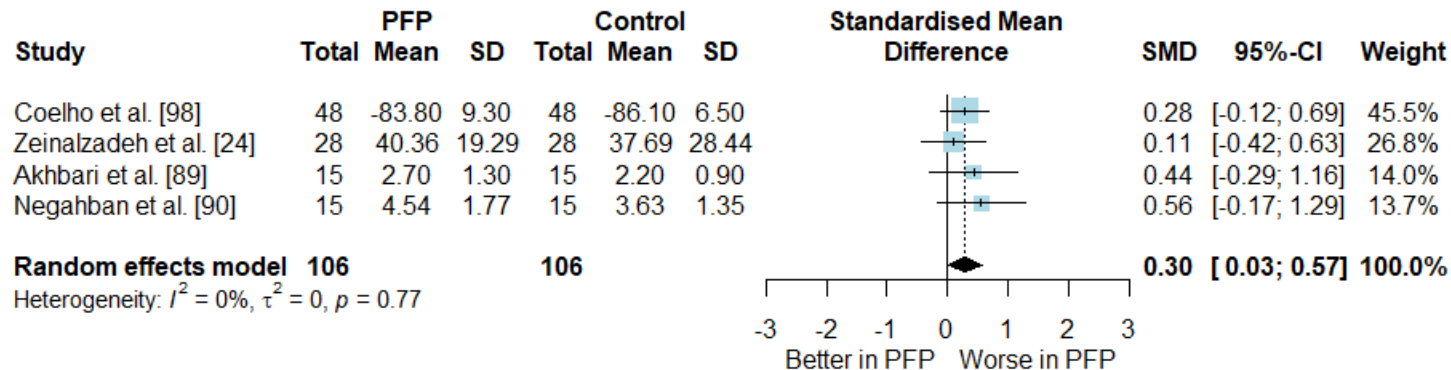
- Balance for Overall postural stability

Subgroup analysis: females



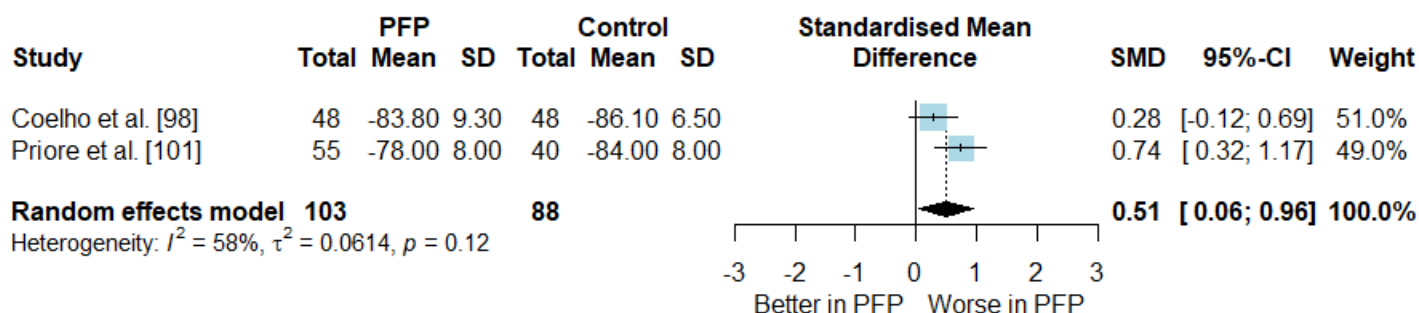
- Balance for Overall postural stability

Subgroup analysis: mixed-sex



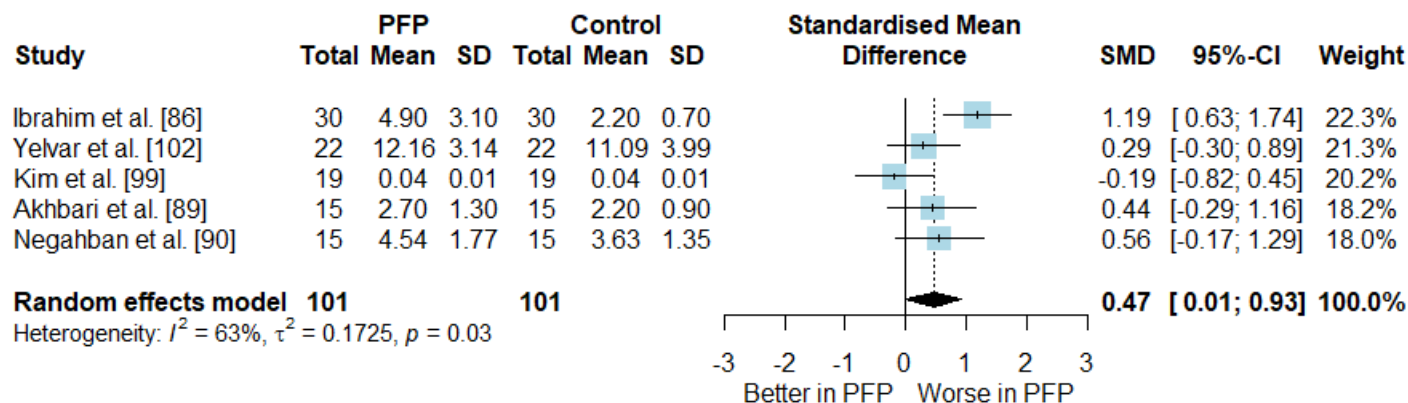
- Balance for Overall postural stability

Subgroup analysis: SEBT



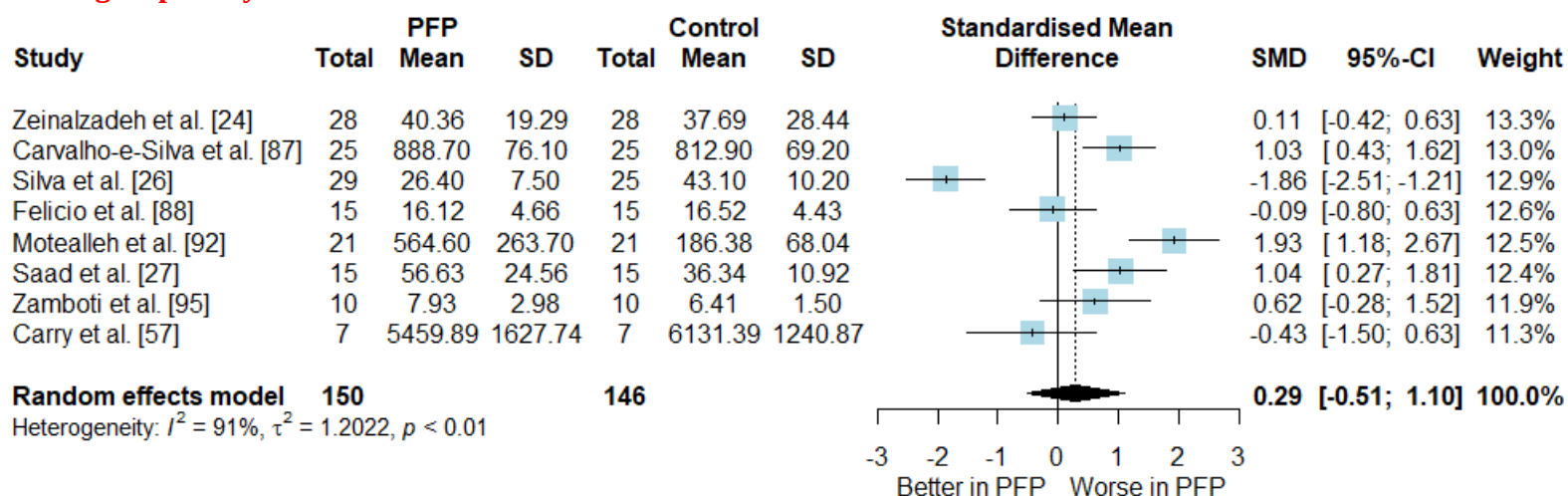
- Balance for Overall postural stability

Subgroup analysis: Posturography



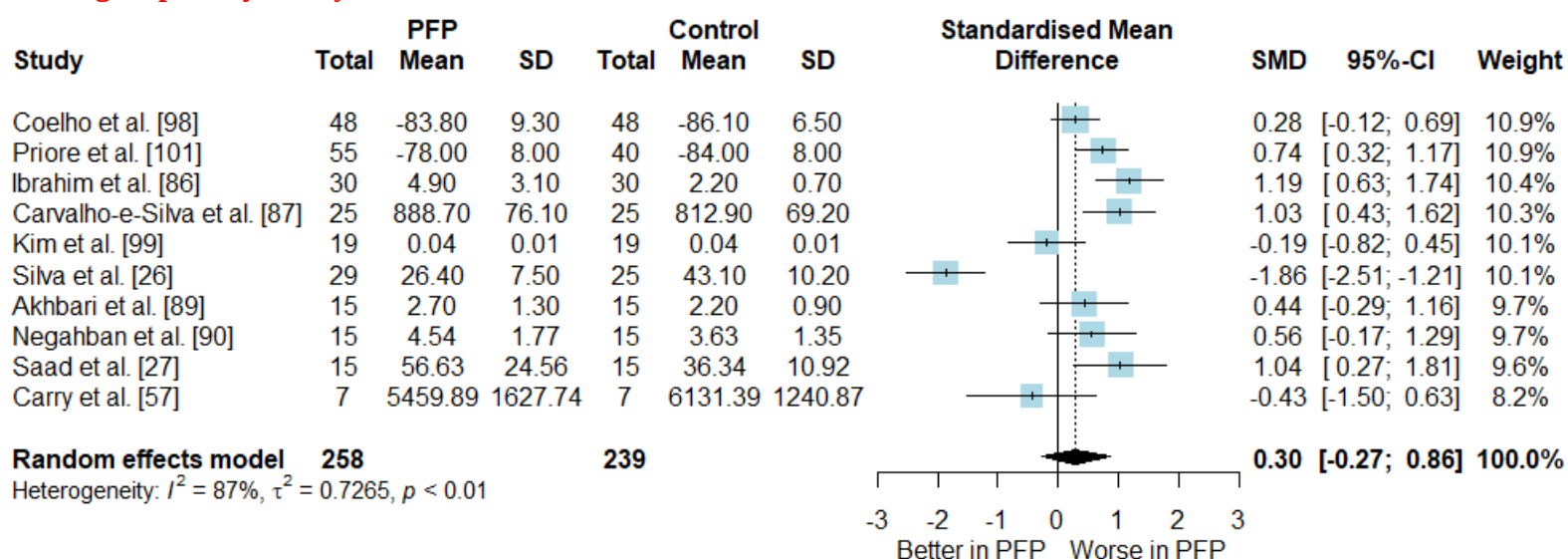
- Balance for Overall postural stability

Subgroup analysis: Centre of Pressure Behavior



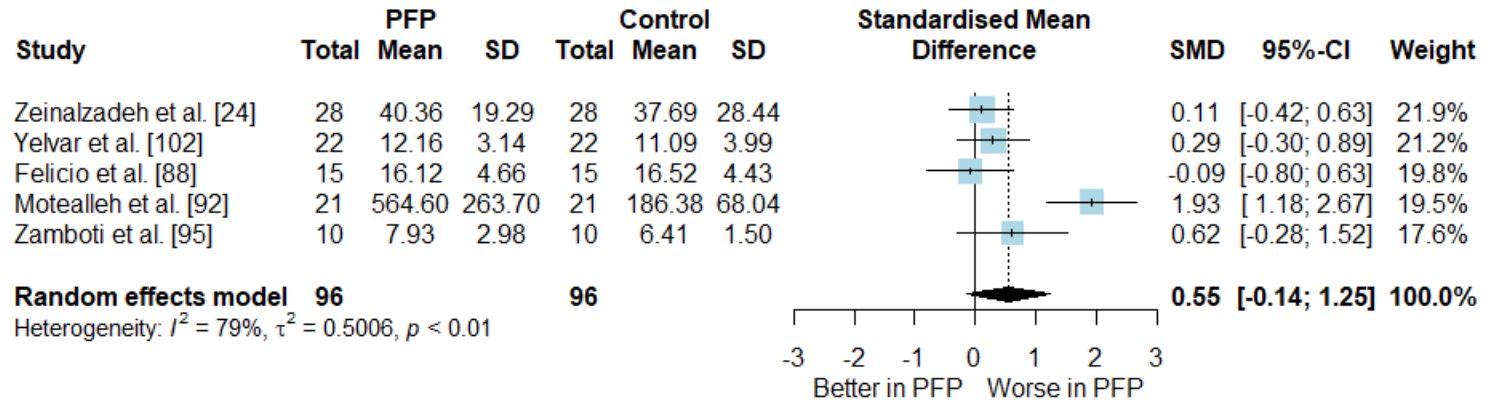
- Balance for Overall postural stability

Subgroup analysis: Dynamic measures



- Balance for Overall postural stability

Subgroup analysis: Static measures

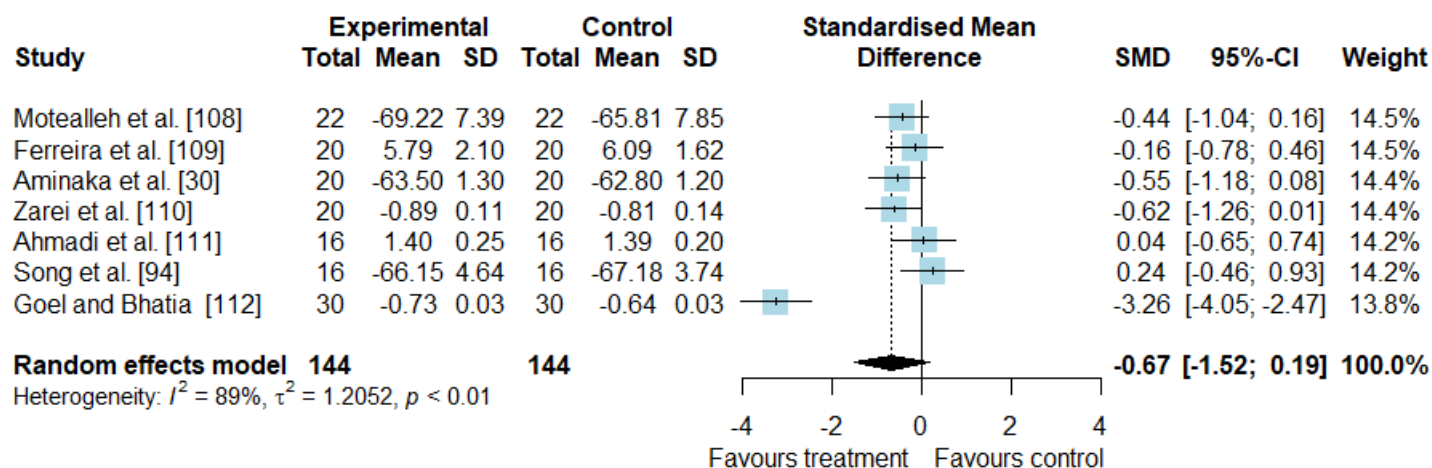


Additional file 7B. Results for Subgroup and Meta-regression analyses for Q2 (Interventions for balance improvement)

Analysis	n Exp/Con	SMD (95% CI)	p-value	I ²	Level of Evidence
AP postural stability;11 studies	215/215	0.59 (0.04 to 1.14)	0.038	84%	⊕⊕⊕⊖ Low
by intervention characteristic					
Passive; 7 studies	144/144	0.67 (−0.19 to 1.52)	0.126	89%	⊕⊕⊕⊖ Low
Exercise; 4 studies	71/71	0.48 (−0.03 to 0.99)	0.063	54%	⊕⊖⊖⊖ Very Low
by comparator					
Sham/no intervention; 8 studies	164/165	0.63 (−0.12 to 1.38)	0.102	88%	⊕⊕⊕⊖ Low
Exercise; 3 studies	51/50	0.49 (−0.03 to 1.00)	0.065	40%	⊕⊕⊕⊖ Low
by design					
Parallel; 7 studies	127/127	0.39 (0.06 to 0.72)	0.019	39%	⊕⊕⊕⊕ Moderate
Crossover; 4 studies	88/88	0.99 (−0.50 to 2.49)	0.194	94%	⊕⊖⊖⊖ Very Low
by study interventions					
Balance specific; 2 studies	45/45	0.89 (0.46 to 1.33)	<0.001	0%	⊕⊖⊖⊖ Very Low
Not specific; 9 studies	170/170	0.52 (−0.16 to 1.20)	0.133	86%	⊕⊕⊕⊖ Low
Meta-regression					
- age = B=0.01, 95% CI −0.10 to 0.13; p=0.81; R ² =0%; I ² =85%					
- treatment duration (weeks) = B=0.04, 95% CI −0.09 to 0.16; p=0.53; R ² =0%; I ² =85%					

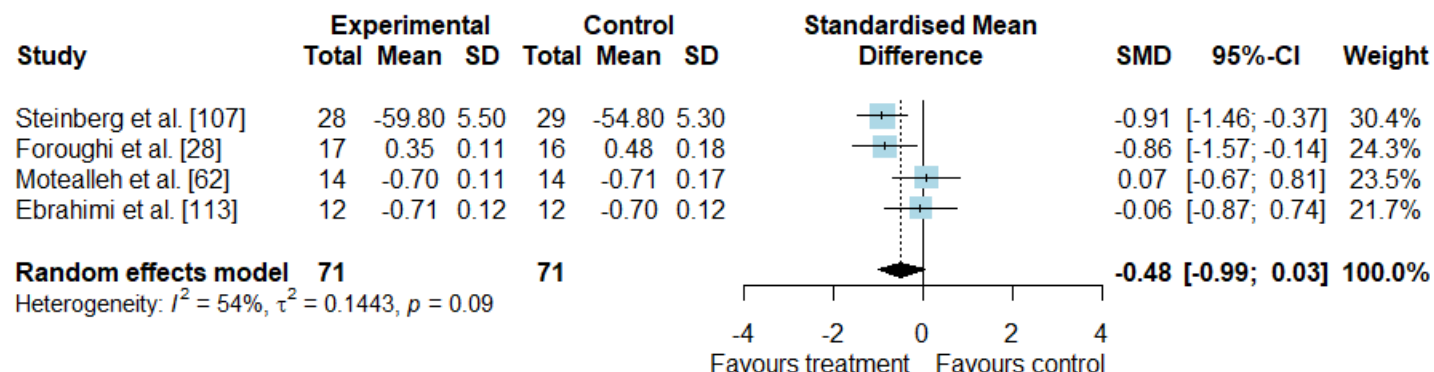
- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: studies that applied passive interventions



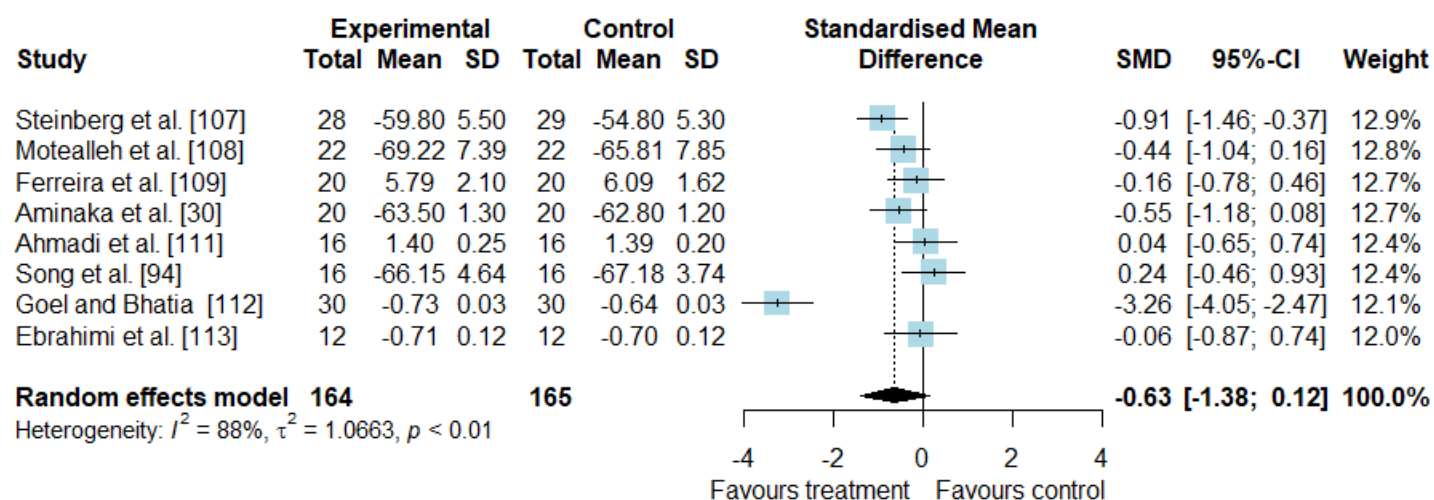
- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: studies that applied exercise as intervention



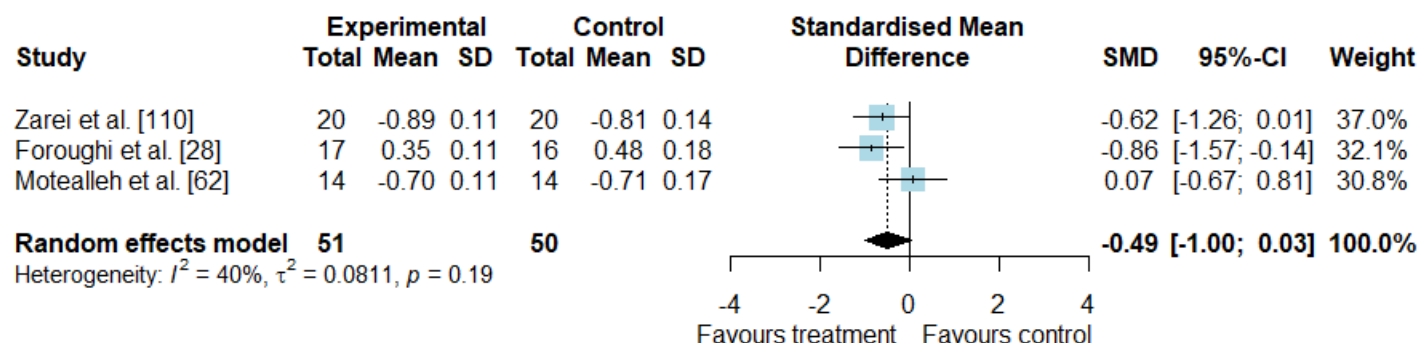
- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: studies that used no intervention/sham as control intervention



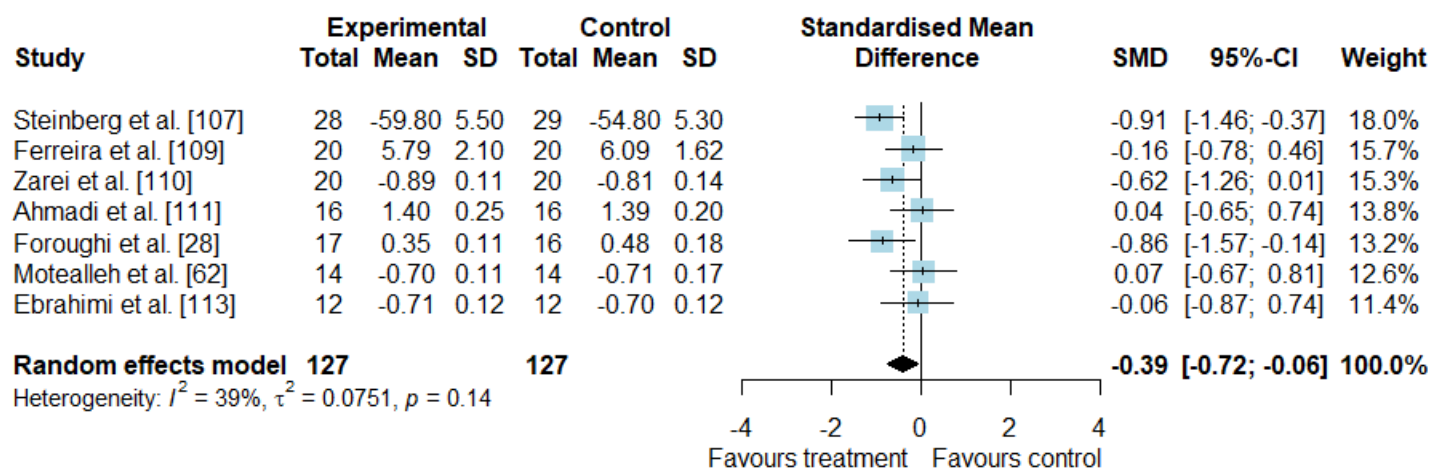
- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: studies that used exercise protocols as control intervention



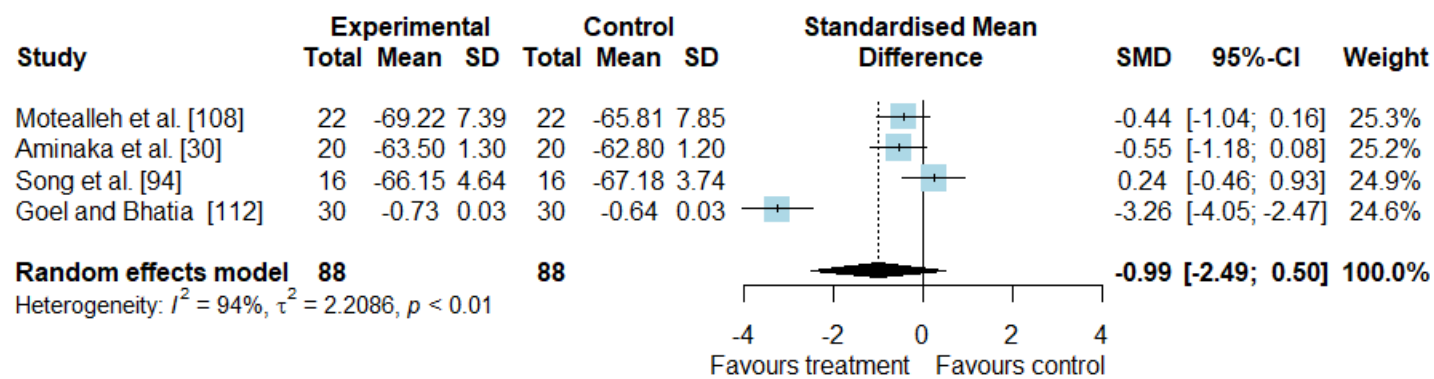
- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: parallel-controlled trials



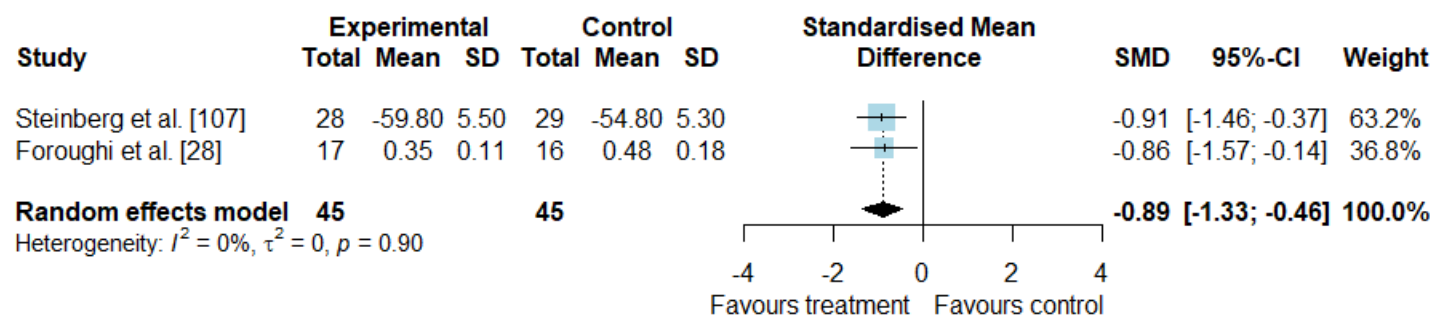
- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: crossover-controlled trials



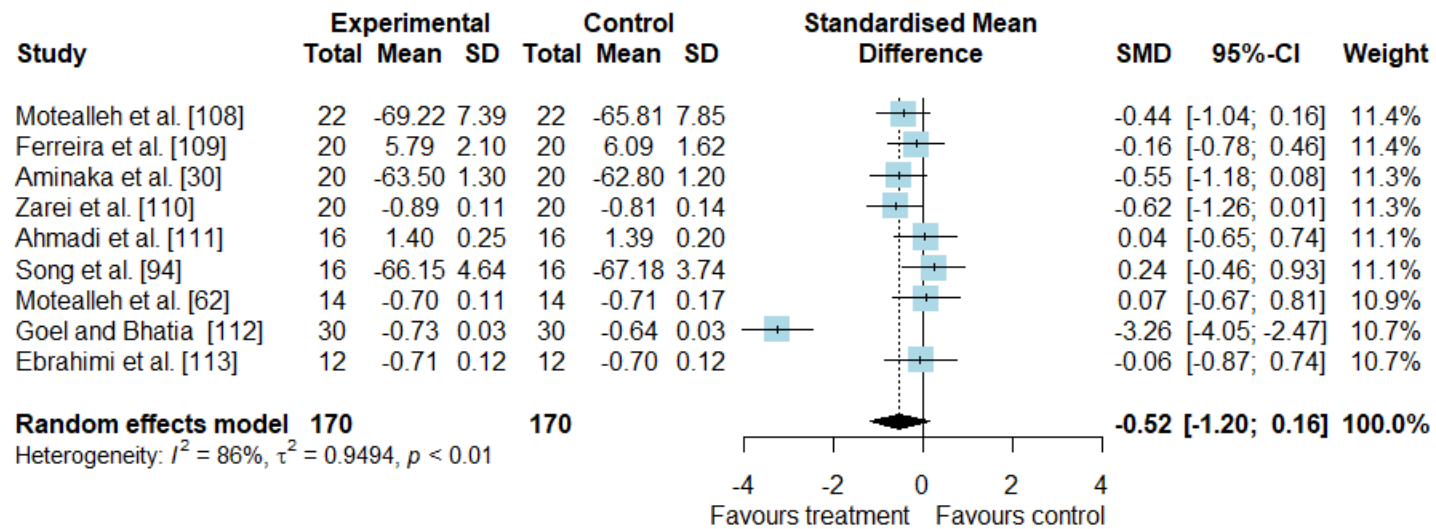
- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: studies aiming to evaluate the effects of balance exercises



- Comparison Intervention x Control on Balance for AP postural stability

Subgroup analysis: studies aiming to evaluate the effects of intervention not related to balance exercises

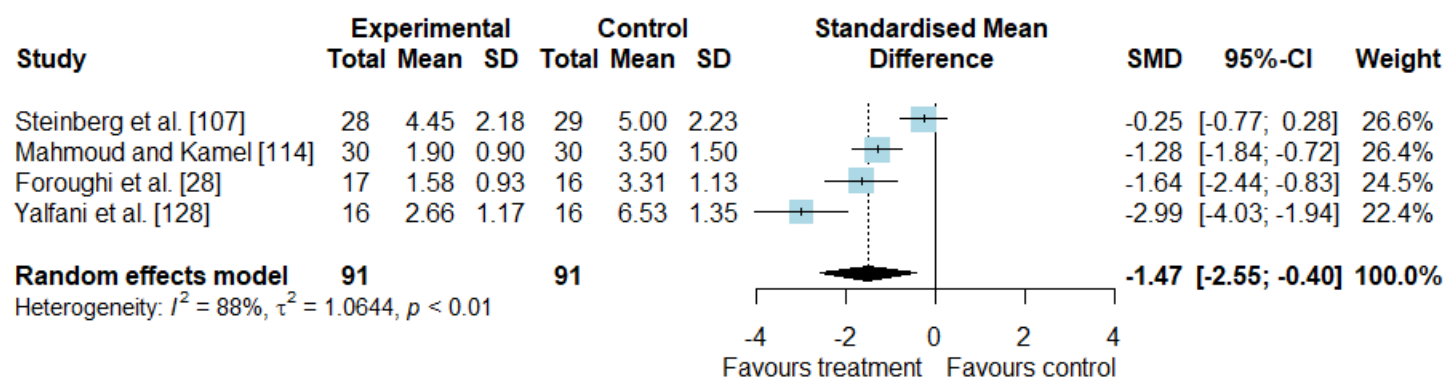


Additional file 7C. Results for Subgroup and Meta-regression analyses for Q3 (Balance exercise for pain and function)

Analysis	n Exp/Con	SMD (95% CI)	p-value	I ²	Level of Evidence
Pain; 14 studies	439/398	0.82 (0.30 to 1.33)	0.002	89%	⊕⊕⊕⊖ Low
Subgroup analyses					
<i>by study aim</i>					
Balance specific; 4 studies	91/91	1.47 (0.40 to 2.55)	0.007	88%	⊕⊕⊕⊖ Very Low
Not specific; 10 studies	348/307	0.57 (0.01 to 1.11)	0.047	88%	
<i>by comparator</i>					
Minimal interventions; 9 studies	248/232	1.02 (0.35 to 1.69)	0.003	89%	⊕⊕⊕⊖ Low
Exercise; 5 studies	191/166	0.46 (−0.35 to 1.28)	0.266	88%	⊕⊕⊕⊖ Low
<i>by interventions</i>					
Balance only; 2 studies	44/45	1.58 (−1.11 to 4.26)	0.249	95%	⊕⊕⊕⊖ Very Low
Balance + exercise; 12 studies	395/353	0.71 (0.21 to 1.21)	0.006	88%	⊕⊕⊕⊕ Moderate
Meta-regression					
- age = B=0.05, 95% CI −0.06 to 0.15; p=0.42; R ² =0%; I ² =89%					
- treatment duration (weeks) = B=0.07, 95% CI −0.05 to 0.19; p=0.26; R ² =0%; I ² =89%					
Function; 10 studies	333/291	0.45 (0.13 to 0.78)	0.006	68%	⊕⊕⊕⊕ Moderate
Subgroup analyses					
<i>by study aim</i>					
Balance specific; 1 study				Not applicable	
Not specific; 9 studies	316/275	0.38 (0.06 to 0.71)	0.019	65%	⊕⊕⊕⊕ Moderate
<i>by comparator</i>					
Minimal interventions; 6 studies	172/155	0.51 (0.03 to 0.99)	0.036	73%	⊕⊕⊕⊕ Moderate
Exercise; 4 studies	161/136	0.37 (−0.09 to 0.83)	0.114	62%	⊕⊕⊕⊖ Low
<i>by interventions</i>					
Balance only; no study				Not applicable	
Balance + exercise; 10 studies					
Meta-regression					
- age = B=−0.05, 95% CI −0.20 to 0.08; p=0.40; R ² =0%; I ² =68%					
- treatment duration (weeks) = B=−0.04, 95% CI −0.12 to 0.05; p=0.40; R ² =0%; I ² =70%					

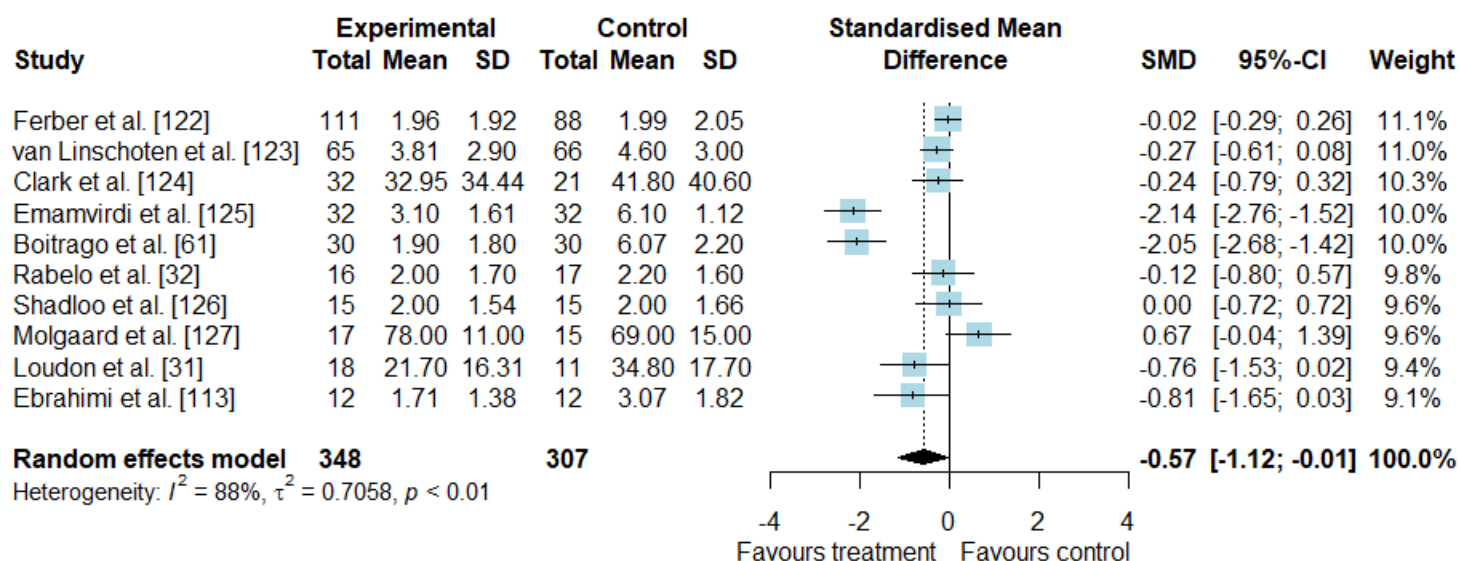
- Comparison Balance x No balance interventions on Pain

Subgroup analysis: studies aiming to evaluate the effects of balance exercises



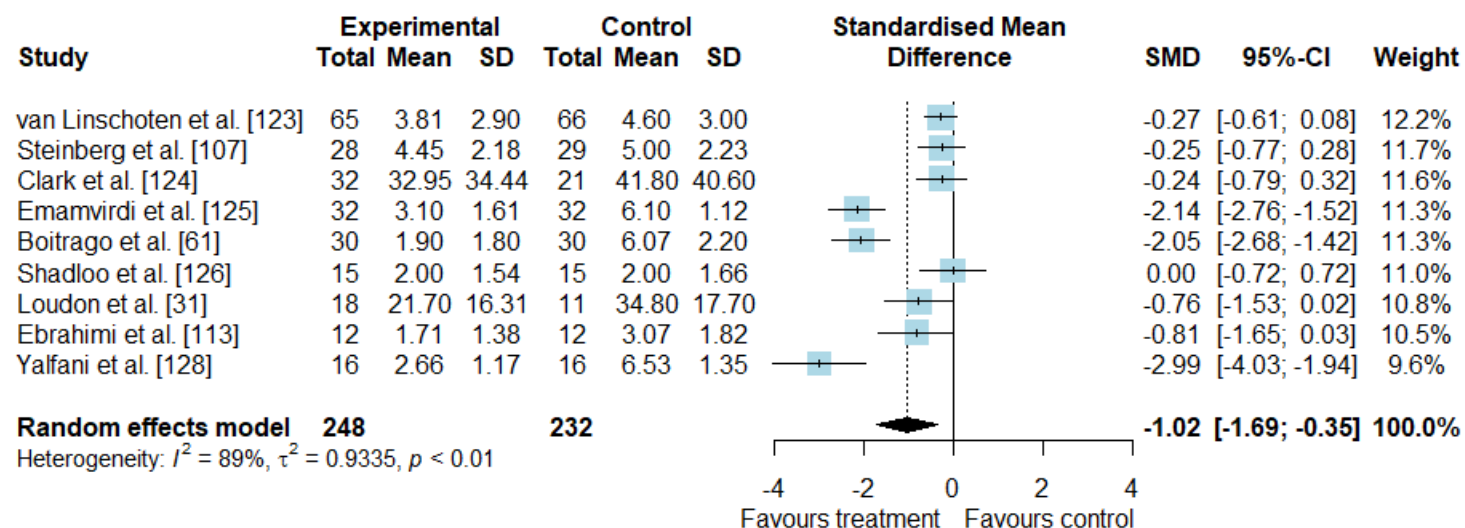
- Comparison Balance x No balance interventions on Pain

Subgroup analysis: studies aiming to evaluate the effects of exercise in general



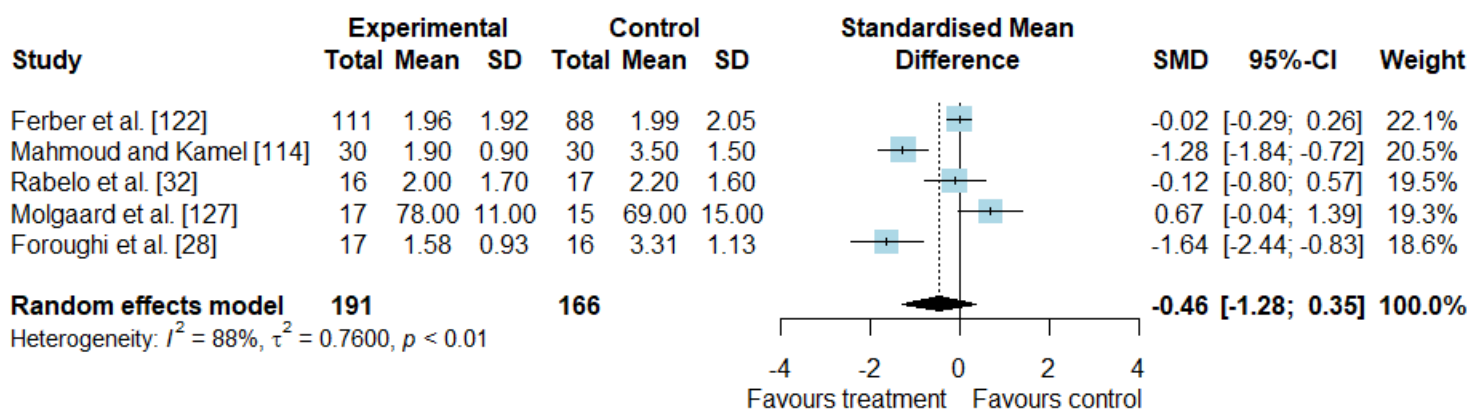
- Comparison Balance x No balance interventions on Pain

Subgroup analysis: control interventions were minimal intervention protocols



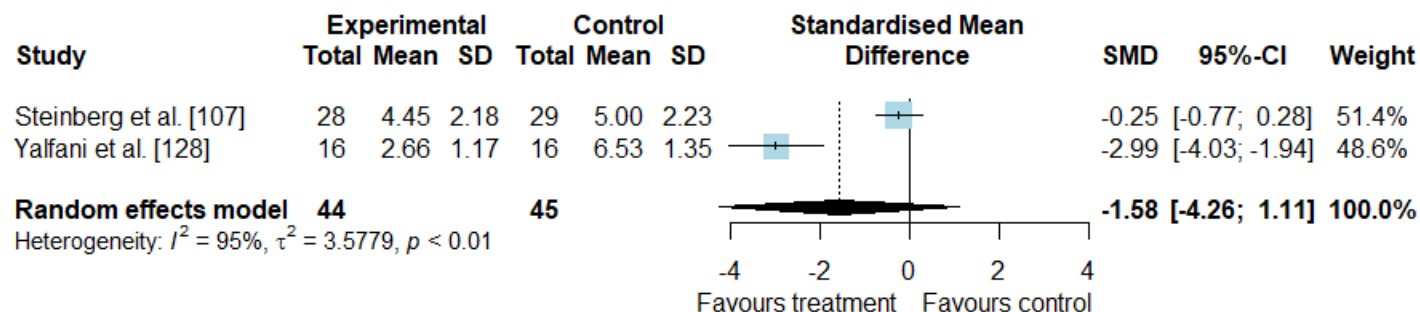
- Comparison Balance x No balance interventions on Pain

Subgroup analysis: control intervention were exercise protocols



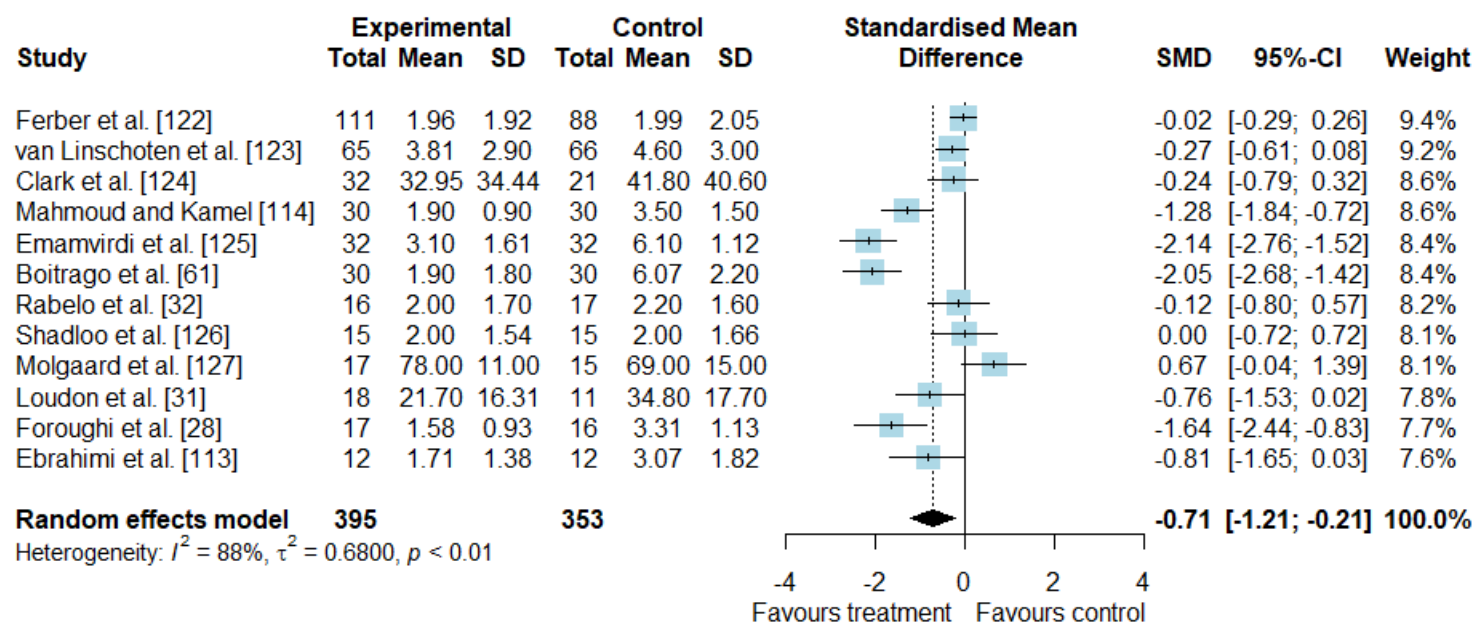
- Comparison Balance x No balance interventions on Pain

Subgroup analysis: experimental interventions were only balance exercises



- Comparison Balance x No balance interventions on Pain

Subgroup analysis: experimental interventions were only exercise protocols



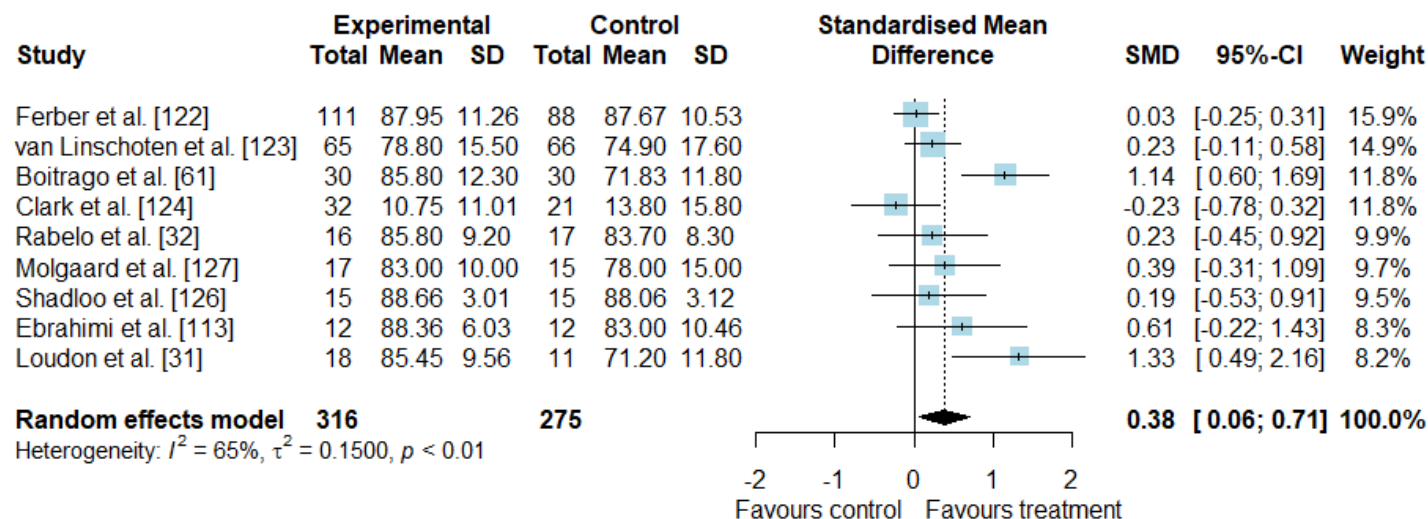
- Comparison Balance x No balance interventions on Function (PROMs)

Subgroup analysis: studies aiming to evaluate the effects of balance exercises

NOT APPLICABLE

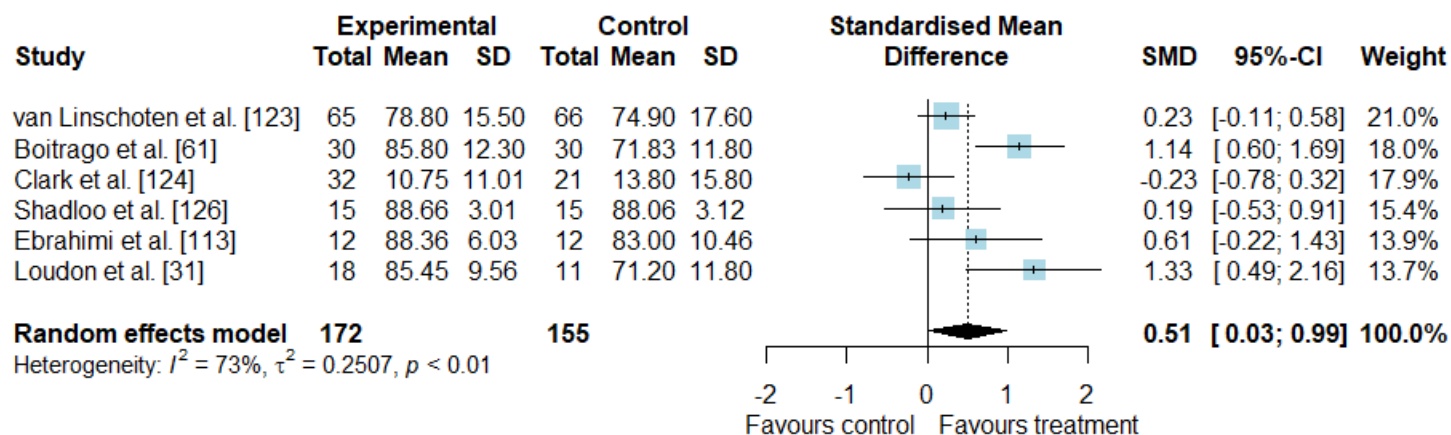
- Comparison Balance x No balance interventions on Function (PROMs)

Subgroup analysis: studies aiming to evaluate the effects of exercise in general



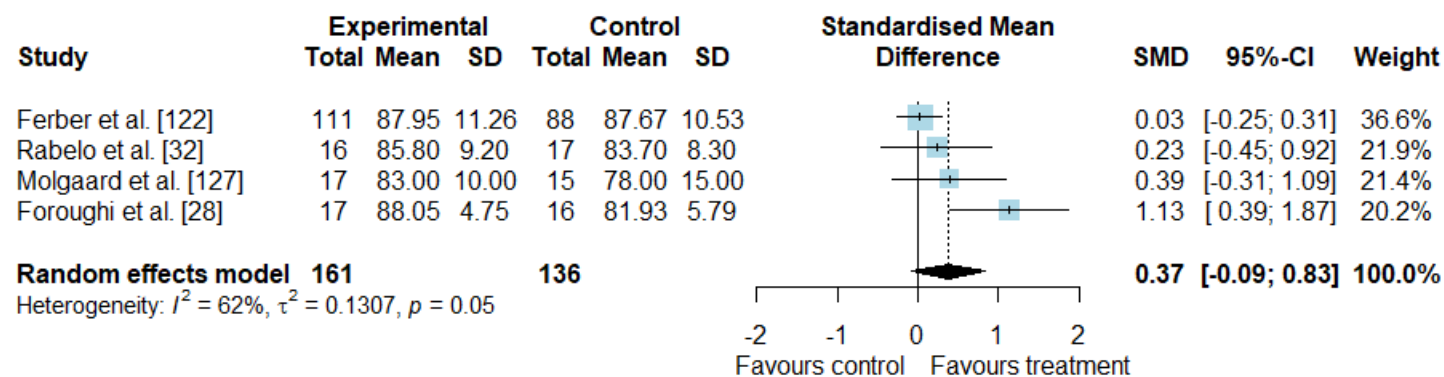
- Comparison Balance x No balance interventions on Function (PROMs)

Subgroup analysis: control interventions were minimal intervention protocols



- Comparison Balance x No balance interventions on Function (PROMs)

Subgroup analysis: control intervention were exercise protocols



- Comparison Balance x No balance interventions on Function (PROMs)

Subgroup analysis: experimental interventions were only balance exercises

NOT APPLICABLE

- Comparison Balance x No balance interventions on Function (PROMs)

Subgroup analysis: experimental interventions were only exercise protocols

NOT APPLICABLE