Diakonhjemmet Sykehus

Development of recommendations/points to consider for physical activity in people with inflammatory arthritis and osteoarthritis

Overview of the effectiveness of exercise in SpA

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Zürich

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Modalities and expected outcomes

Exercise modality	Outcome
Cardorespiratory	(aerobic capacity; VO2 max), **disease activity, symptoms (pain, fatigue, stiffness), physical function, CVD risk profile**, inflammatory markers?
Strength	(muscle strength), **disease activity, symptoms, (pain, fatigue, stiffness), physical function, CVD risk profile**, inflammatory markers?
Flexibility	**mobility, physical function, symptoms**
Neuromuscular (balance)	**physical function**

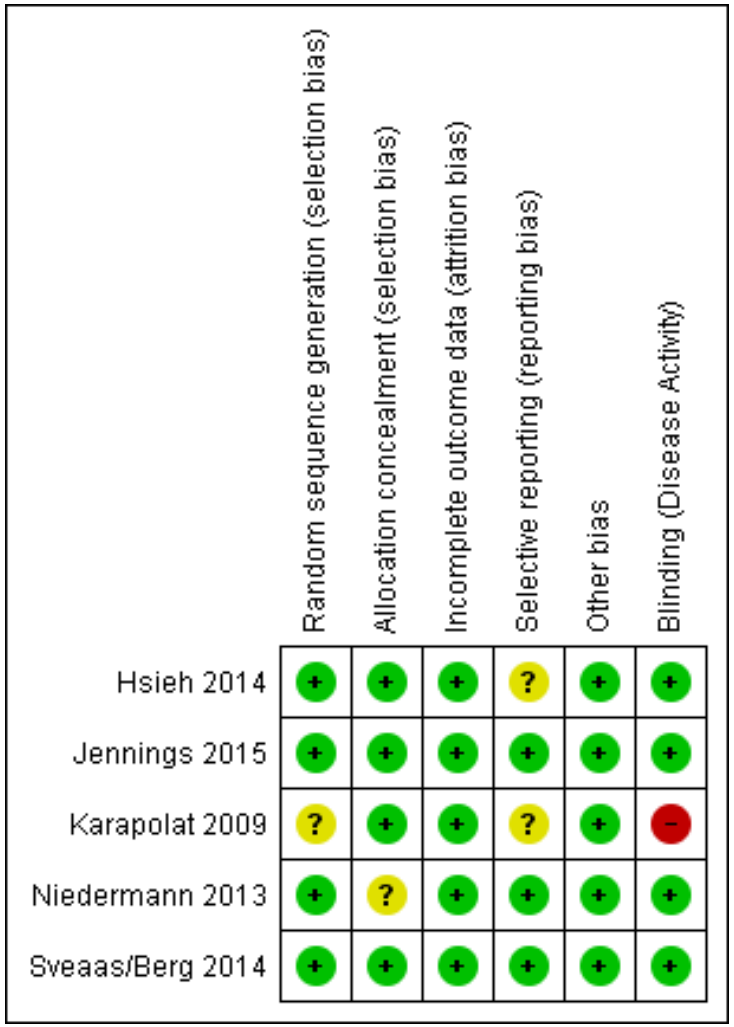
Evidence of effects of cardiorespiratory and strength exercise

Trial	Patient population*	Duration and exercise mode
1. Hsieh et al.[40] 2014, Taiwan	19 (AS)	3 months, cardiorespiratory and strength
2. Jennings et al.[41] 2015, Brazil	70 (AS)	12 weeks, cardiorespiratory
3. Karapolat et al.[42] 2009, Turkey	37 (AS)	6 weeks, cardiorespiratory
4. Niedermann et al.[47] 2013, Switzerland	106 (AS)	12 weeks, cardiorespiratory
5. Sveaas/Berg et al.[49] 2014, Norway	24 (axial SpA)	12 weeks, cardiorespiratory and strength

Studies included if exercise programs followed the ACSM exercise recommendations

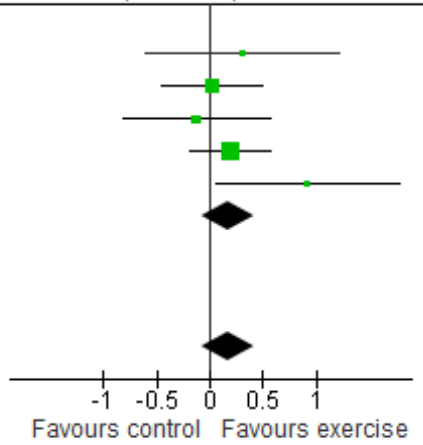
Date of literature search: April 2016

Risk of bias


Random sequence generation (selection bias)
Allocation concealment (selection bias)
Incomplete outcome data (attrition bias)
Selective reporting (reporting bias)
Other bias
Blinding (Disease Activity)
Hsieh 2014
Jennings 2015
Karapolat 2009
Niedermann 2013
Sveaas/Berg 2014

Effects of cardiorespiratory and strength exercise on disease activity (BASDAI)

Study or Subgroup	Control Mean	Control SD	Control Total	Exercise Mean	Exercise SD	Exercise Total	Weight	Std. Mean Difference IV, Random, 95% CI	Risk of Bias A B C D E F
1.9.1 Final value scores									
Hsieh 2014	4.5	3	10	3.7	1.8	9	7.8%	0.30 [-0.60, 1.21]	+ + + ? + +
Jennings 2015	2	0.94	35	1.98	0.93	35	28.3%	0.02 [-0.45, 0.49]	+ + + + + +
Karapolat 2009	2.03	1.86	12	2.27	1.83	25	13.4%	-0.13 [-0.82, 0.56]	? + + ? + -
Niedermann 2013	3.35	1.456	53	3.07	1.456	53	41.9%	0.19 [-0.19, 0.57]	+ ? + + + +
Sveaas/Berg 2014	5.2	2	14	3.3	2	10	8.7%	0.92 [0.06, 1.78]	+ + + + + +
Subtotal (95% CI)			**124**			**132**	**100.0%**	**0.17 [-0.08, 0.43]**	
Heterogeneity: Tau² = 0.00; Chi² = 4.10, df = 4 (P = 0.39); I² = 3%									
Test for overall effect: Z = 1.32 (P = 0.19)									
Total (95% CI)			**124**			**132**	**100.0%**	**0.17 [-0.08, 0.43]**	
Heterogeneity: Tau² = 0.00; Chi² = 4.10, df = 4 (P = 0.39); I² = 3%									
Test for overall effect: Z = 1.32 (P = 0.19)									
Test for subgroup differences: Not applicable									

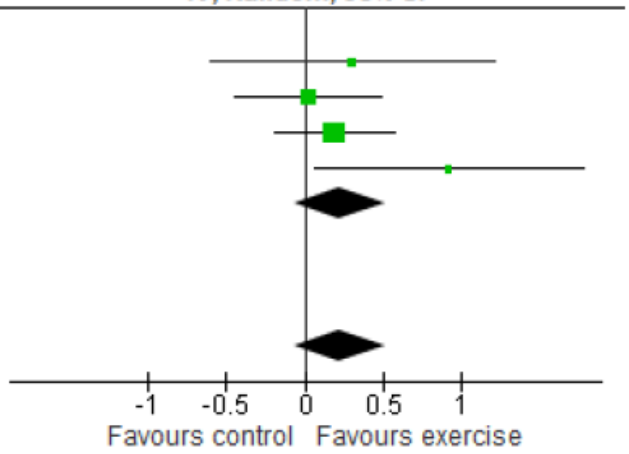


Risk of bias legend

(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Incomplete outcome data (attrition bias)
(D) Selective reporting (reporting bias)
(E) Other bias
(F) Blinding (Disease Activity)

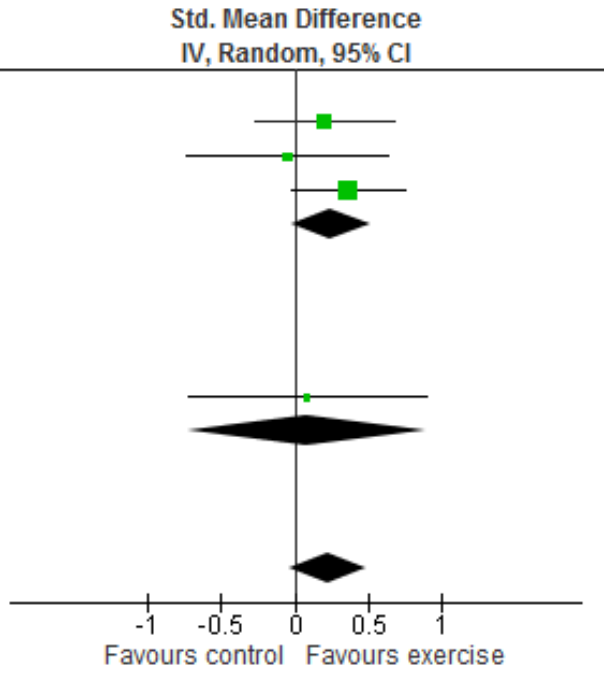
Effects of cardiorespiratory and strength exercise on disease activity (BASDAI) – 4 studies

Study or Subgroup	Control Mean	Control SD	Control Total	Exercise Mean	Exercise SD	Exercise Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.9.1 Final value scores								
Hsieh 2014	4.5	3	10	3.7	1.8	9	9.7%	0.30 [-0.60, 1.21]
Jennings 2015	2	0.94	35	1.98	0.93	35	32.9%	0.02 [-0.45, 0.49]
Niedermann 2013	3.35	1.456	53	3.07	1.456	53	46.7%	0.19 [-0.19, 0.57]
Sveaas/Berg 2014	5.2	2	14	3.3	2	10	10.7%	0.92 [0.06, 1.78]
Subtotal (95% CI)			**112**			**107**	**100.0%**	**0.22 [-0.06, 0.51]**
Heterogeneity: Tau² = 0.01; Chi² = 3.27, df = 3 (P = 0.35); I² = 8%								
Test for overall effect: Z = 1.53 (P = 0.13)								
Total (95% CI)			**112**			**107**	**100.0%**	**0.22 [-0.06, 0.51]**
Heterogeneity: Tau² = 0.01; Chi² = 3.27, df = 3 (P = 0.35); I² = 8%								
Test for overall effect: Z = 1.53 (P = 0.13)								
Test for subgroup differences: Not applicable								



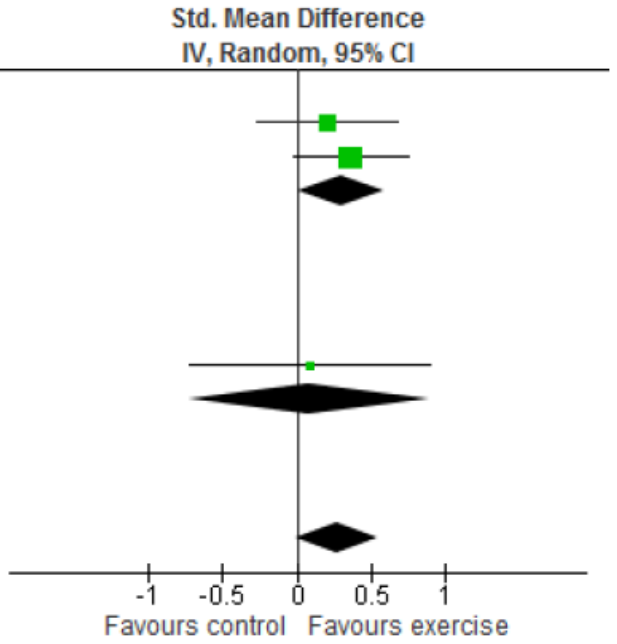
Effects of cardiorespiratory and strength exercises on pain

Study or Subgroup	Control Mean	Control SD	Control Total	Exercise Mean	Exercise SD	Exercise Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.3.1 Final value scores								
Jennings 2015	-60.3	22.5	35	-65	22.6	35	30.3%	0.21 [-0.26, 0.68]
Karapolat 2009	21.04	34.3	12	22.5	27	25	14.1%	-0.05 [-0.74, 0.64]
Niedermann 2013	4.15	2.184	53	3.31	2.4024	53	45.4%	0.36 [-0.02, 0.75]
Subtotal (95% CI)			**100**			**113**	**89.8%**	**0.25 [-0.03, 0.52]**
Heterogeneity: Tau² = 0.00; Chi² = 1.09, df = 2 (P = 0.58); I² = 0%								
Test for overall effect: Z = 1.76 (P = 0.08)								
1.3.2 Change from baseline scores								
Sveaas/Berg 2014	-0.86	2.35	14	-1.1	3.17	10	10.2%	0.09 [-0.73, 0.90]
Subtotal (95% CI)			**14**			**10**	**10.2%**	**0.09 [-0.73, 0.90]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.21 (P = 0.84)								
Total (95% CI)			**114**			**123**	**100.0%**	**0.23 [-0.03, 0.49]**
Heterogeneity: Tau² = 0.00; Chi² = 1.22, df = 3 (P = 0.75); I² = 0%								
Test for overall effect: Z = 1.74 (P = 0.08)								
Test for subgroup differences: Chi² = 0.13, df = 1 (P = 0.71), I² = 0%								



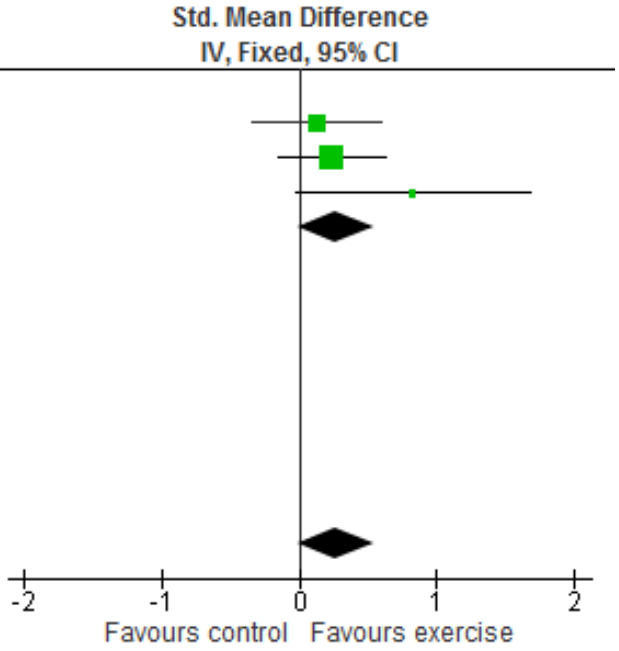
Effects of cardiorespiratory and strength exercises on pain – 4 studies

Study or Subgroup	Control Mean	Control SD	Control Total	Exercise Mean	Exercise SD	Exercise Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.3.1 Final value scores								
Jennings 2015	-60.3	22.5	35	-65	22.6	35	35.3%	0.21 [-0.26, 0.68]
Niedermann 2013	4.15	2.184	53	3.31	2.4024	53	52.9%	0.36 [-0.02, 0.75]
Subtotal (95% CI)			**88**			**88**	**88.2%**	**0.30 [0.00, 0.60]**
Heterogeneity: Tau² = 0.00; Chi² = 0.26, df = 1 (P = 0.61); I² = 0%								
Test for overall effect: Z = 1.98 (P = 0.05)								
1.3.2 Change from baseline scores								
Sveaas/Berg 2014	-0.86	2.35	14	-1.1	3.17	10	11.8%	0.09 [-0.73, 0.90]
Subtotal (95% CI)			**14**			**10**	**11.8%**	**0.09 [-0.73, 0.90]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.21 (P = 0.84)								
Total (95% CI)			**102**			**98**	**100.0%**	**0.27 [-0.00, 0.55]**
Heterogeneity: Tau² = 0.00; Chi² = 0.50, df = 2 (P = 0.78); I² = 0%								
Test for overall effect: Z = 1.93 (P = 0.05)								
Test for subgroup differences: Chi² = 0.24, df = 1 (P = 0.63), I² = 0%								



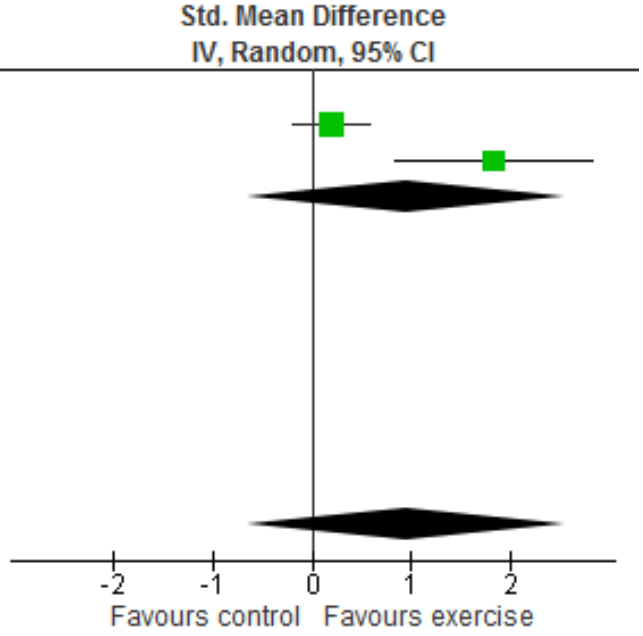
Effects of cardiorespiratory and strength exercises on fatigue

Study or Subgroup	Control Mean	Control SD	Control Total	Exercise Mean	Exercise SD	Exercise Total	Weight	Std. Mean Difference IV, Fixed, 95% CI
1.4.1 Final value scores								
Jennings 2015	-59.6	21.7	35	-62.7	24.1	35	35.6%	0.13 [-0.34, 0.60]
Niedermann 2013	4.29	2.3296	53	3.73	2.3296	53	53.6%	0.24 [-0.14, 0.62]
Sveaas/Berg 2014	5.79	2.61	14	3.7	2.21	10	10.8%	0.82 [-0.03, 1.67]
Subtotal (95% CI)			**102**			**98**	**100.0%**	**0.26 [-0.02, 0.54]**
Heterogeneity: Chi² = 1.97, df = 2 (P = 0.37); I² = 0%								
Test for overall effect: Z = 1.85 (P = 0.06)								
1.4.2 Change from baseline scores								
Subtotal (95% CI)			**0**			**0**		**Not estimable**
Heterogeneity: Not applicable								
Test for overall effect: Not applicable								
Total (95% CI)			**102**			**98**	**100.0%**	**0.26 [-0.02, 0.54]**
Heterogeneity: Chi² = 1.97, df = 2 (P = 0.37); I² = 0%								
Test for overall effect: Z = 1.85 (P = 0.06)								
Test for subgroup differences: Not applicable								



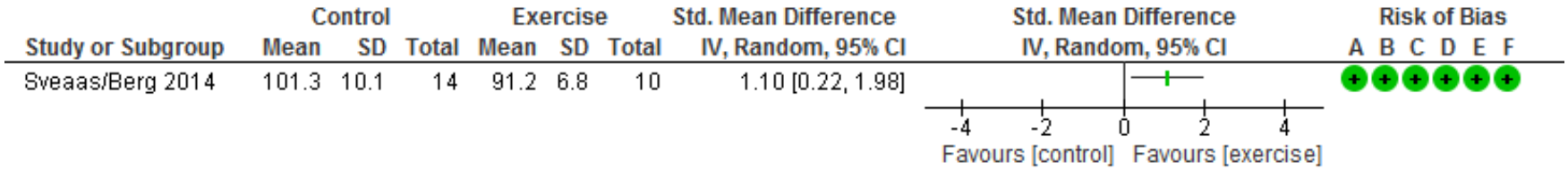
Effects of cardiorespiratory and strength exercises on stiffness

Study or Subgroup	Control Mean	Control SD	Control Total	Exercise Mean	Exercise SD	Exercise Total	Weight	Std. Mean Difference IV, Random, 95% CI
1.6.1 Final value scores								
Niedermann 2013	0.46	2.05	50	0.06	2.01	50	54.0%	0.20 [-0.20, 0.59]
Sveaas/Berg 2014	6.36	1.55	14	2.8	2.25	10	46.0%	1.84 [0.85, 2.83]
Subtotal (95% CI)			**64**			**60**	**100.0%**	**0.95 [-0.65, 2.56]**
Heterogeneity: Tau² = 1.20; Chi² = 9.13, df = 1 (P = 0.003); I² = 89%								
Test for overall effect: Z = 1.16 (P = 0.25)								
1.6.2 Change from baseline scores								
Subtotal (95% CI)			**0**			**0**		**Not estimable**
Heterogeneity: Not applicable								
Test for overall effect: Not applicable								
Total (95% CI)			**64**			**60**	**100.0%**	**0.95 [-0.65, 2.56]**
Heterogeneity: Tau² = 1.20; Chi² = 9.13, df = 1 (P = 0.003); I² = 89%								
Test for overall effect: Z = 1.16 (P = 0.25)								
Test for subgroup differences: Not applicable								



Cardiovascular risk factors

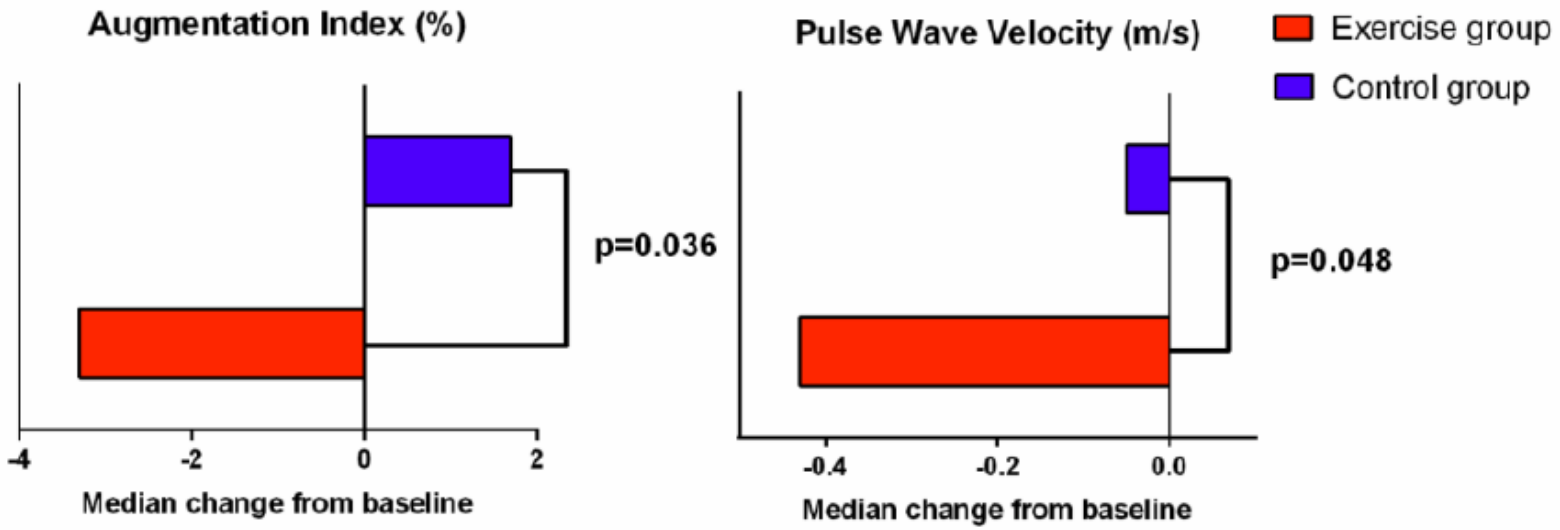
Waist circumference



Risk of bias legend
(A) Random sequence generation (selection bias)
(B) Allocation concealment (selection bias)
(C) Incomplete outcome data (attrition bias)
(D) Selective reporting (reporting bias)
(E) Other bias
(F) Blinding (Disease Activity)

Cardiovascular risk factors

Arterial stiffness

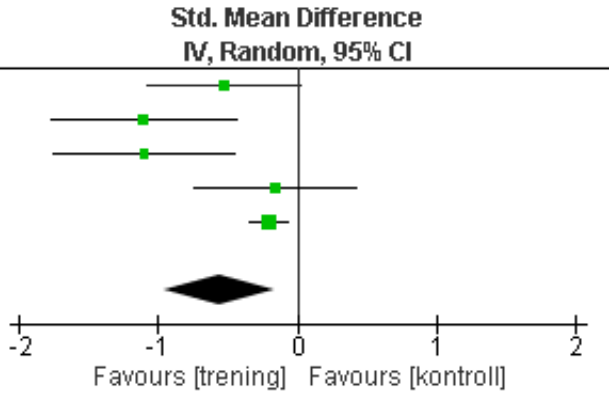


Effects of flexibility exercises on disease activity and pain

Disease activity

Study or Subgroup	Exercise Mean	Exercise SD	Exercise Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Altan et al. 2012	2.1	2	29	3.1	1.7	24	19.2%	-0.53 [-1.08, 0.02]
Durmus et al. 2009	1.42	0.86	38	3	2.4	13	16.4%	-1.11 [-1.78, -0.44]
Durmus et al. 2009 (2)	1.35	0.78	25	2.34	1.01	18	16.7%	-1.10 [-1.75, -0.45]
Maseiro et al. 2013	2.7	1.6	22	3	2.1	23	18.3%	-0.16 [-0.74, 0.43]
Rodriguez-Lozano et al. 2013	2.85	2.3	381	3.33	2.3	375	29.4%	-0.21 [-0.35, -0.07]
Total (95% CI)			**495**			**453**	**100.0%**	**-0.56 [-0.95, -0.16]**

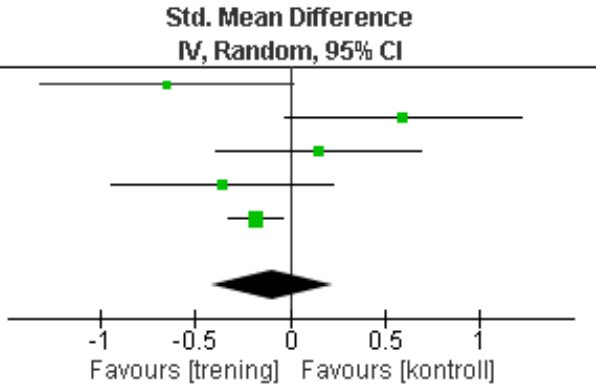
Heterogeneity: Tau² = 0.13; Chi² = 13.84, df = 4 (P = 0.008); I² = 71%
Test for overall effect: Z = 2.75 (P = 0.006)



Pain

Study or Subgroup	Exercise Mean	Exercise SD	Exercise Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Durmus et al. 2009	1.68	1.8	28	3	2.34	13	14.3%	-0.65 [-1.33, 0.02]
Durmus et al. 2009 (2)	0.78	0.12	25	0.69	0.18	18	15.8%	0.60 [-0.02, 1.22]
Kraag et al. 1990	37.4	21.1	25	33.5	28.8	27	18.2%	0.15 [-0.39, 0.70]
Maseiro et al. 2013	11.6	15.8	22	18.4	21.1	23	16.8%	-0.36 [-0.95, 0.23]
Rodriguez-Lozano et al. 2013	2.74	2.8	381	3.26	3	375	34.9%	-0.18 [-0.32, -0.04]
Total (95% CI)			**481**			**456**	**100.0%**	**-0.09 [-0.42, 0.23]**

Heterogeneity: Tau² = 0.07; Chi² = 9.52, df = 4 (P = 0.05); I² = 58%
Test for overall effect: Z = 0.56 (P = 0.57)

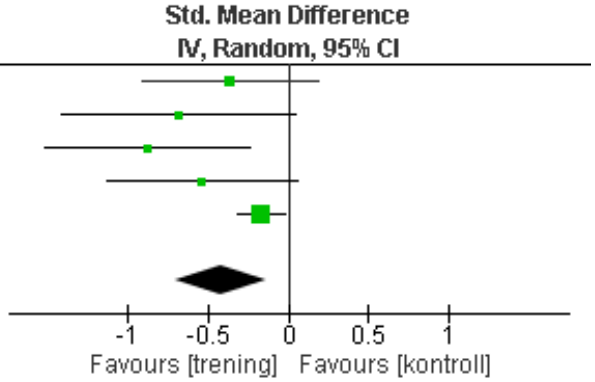


Effects of flexibility exercises on physical function and mobility

Physical function

Study or Subgroup	Exercise Mean	Exercise SD	Exercise Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Altan et al. 2012	1.7	1.6	29	2.3	1.7	24	17.2%	-0.36 [-0.90, 0.19]
Durmus et al. 2009	1.55	1.44	19	2.97	2.71	13	11.6%	-0.68 [-1.40, 0.05]
Durmus et al. 2009 (2)	1.25	1.07	25	2.3	1.32	18	14.1%	-0.87 [-1.51, -0.24]
Maseiro et al. 2013	2.1	1.2	22	3	2	23	15.4%	-0.53 [-1.13, 0.06]
Rodriguez-Lozano et al. 2013	3.06	2.5	381	3.49	2.6	375	41.7%	-0.17 [-0.31, -0.03]
Total (95% CI)			**476**			**453**	**100.0%**	**-0.42 [-0.70, -0.13]**

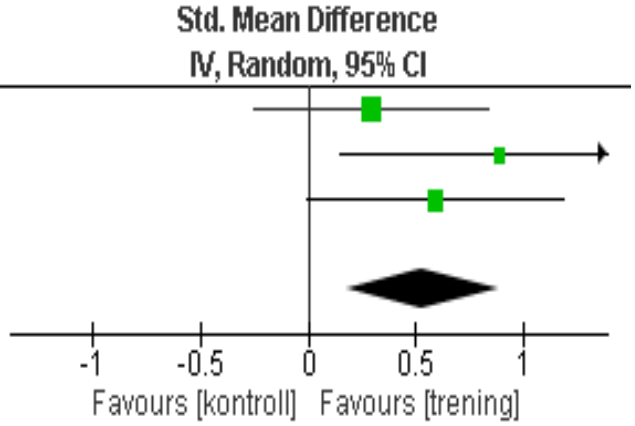
Heterogeneity: Tau² = 0.05; Chi² = 7.27, df = 4 (P = 0.12); I² = 45%
Test for overall effect: Z = 2.85 (P = 0.004)



Mobility

Study or Subgroup	Exercise Mean	Exercise SD	Exercise Total	Control Mean	Control SD	Control Total	Weight	Std. Mean Difference IV, Random, 95% CI
Altan et al. 2012	4.5	2	29	4	1.2	24	42.3%	0.29 [-0.25, 0.84]
Durmus et al. 2009	4.33	1	19	3.42	0.99	13	22.7%	0.89 [0.15, 1.63]
Maseiro et al. 2013	4.5	1.5	22	3.5	1.8	23	35.0%	0.59 [-0.01, 1.19]
Total (95% CI)			**70**			**60**	**100.0%**	**0.53 [0.18, 0.89]**

Heterogeneity: Tau² = 0.00; Chi² = 1.68, df = 2 (P = 0.43); I² = 0%
Test for overall effect: Z = 2.95 (P = 0.003)



Neuromuscular (balance)

- No RCTs identified

Conclusion

- Cardiorespiratory and strength exercises (according to the ACSM exercise recommendations) may reduce symptoms and cardiovascular risk factors without increasing disease activity. Cardiorespiratory and strength exercises are safe and beneficial for patients with SpA

- Flexibility exercise programs may improve mobility and physical function (BASFI) and reduce disease activity (BASDAI), but have no effect on pain