



Supplemental tables

Sarcopenia in Autoimmune and Rheumatic Diseases: A Comprehensive Review

Table S1. Study findings of rheumatoid arthritis and sarcopenia

Table S2. Study findings of rheumatic diseases other than rheumatoid arthritis and sarcopenia

Table S3. Study findings of inflammatory bowel disease and sarcopenia

Table 1. Study Findings of Rheumatoid Arthritis and Sarcopenia.

Author	Study Findings	Definition of Sarcopenia
Vulnerability		
Dao et al. [1]	Female early RA patients in Vietnam had lower appendicular LM.	FFMI (Hull et al. [2])
Doğan et al. [3]	Female RA patients had lower SMI and higher sarcopenia prevalence.	SMI (Janssen et al. [4])
Santo et al. [5]	According to meta-analysis, rheumatoid cachexia is a common comorbidity in RA whose prevalence is 15-32%.	-
Munro et al. [6]	RA patients had lower upper arm muscle mass.	-
Kasher et al. [7]	Female RA patients in Kazakhstan had lower MMI.	-
Associated factors		
Dao et al. [1]	Disease activity, functional status, RF seropositivity was associated with abnormal body composition in female RA patients.	FFMI (Hull et al. [2])
Giles et al. [8]	CRP levels, RF seropositivity, joint deformity, functional limitation was associated with abnormal body composition in RA patients.	SMI (Janssen et al. [4])
Ngeuleu et al. [9]	Bone erosion, normal/over fat BMI were associated to sarcopenia but disease activity and functional status were not associated in RA patients.	SMI (Baumgartner et al. [10])
Lin et al. [11]	Functional limitation (HAQ-DI > 1) and joint damage were positively associated with sarcopenia in RA patients.	SMI (AWGS [12])
Tada et al. [13]	BMI, body fat mass, and MMP3 were associated with sarcopenia in RA patients.	AWGS [12]
Mochizuki et al. [14]	Age, BMI, CRP, hip bone mineral density were significantly associated with sarcopenia in RA patients.	AWGS [12]
Torii et al. [15]	Age, longer disease duration, joint destruction and malnutrition were associated with sarcopenia in RA patients.	EWGSOP [16], AWGS [12]
Vlietstra et al. [17]	Higher body fat was associated with sarcopenia but self-reported fatigue and physical function were not associated in RA patients.	SMI (FNIH [18])
Munro et al. [6]	The acute phase response (ESR, CRP) had a significant correlation with reduced fat free mass in female RA patients.	-
Müller et al. [19]	Higher ESR, CRP, lower protein intake, worse functional status were associated with having low lean mass in early RA patients.	ALM/height ² (male < 8.0586 kg/h ² female < 6.0359 kg/h ²)

Alkan Melikoğlu [20]	SMI of RA patients had a negative correlation with functional status.	-
Beenakker et al. [21]	The low handgrip strength was negatively associated with disease duration but not associated with age between 35 and 65 years in RA patients.	-
Drugs/Treatment		
Giles et al. [8]	Not using DMARDs was associated with abnormal body composition in RA patients.	SMI (Janssen et al. [4])
Ngeuleu et al. [9]	There was no significant difference according to duration of steroid use between sarcopenic and non-sarcopenic RA group.	SMI (Baumgartner et al. [10])
Tournadre et al. [22]	TCZ was effective in gain of weight, lean mass, appendicular lean mass and SMI without fat mass gain in RA patients.	SMI (Baumgartner et al. [10])
Torii et al. [15]	Use of bDMARDs was negatively associated with sarcopenia in RA patients.	EWGSOP [16], AWGS [12]
Vlietstra et al. [17]	GC use was associated with sarcopenia in RA patients.	SMI (FNIH [18])
Müller et al. [19]	Current GC use was associated with having low lean mass in the early RA group.	ALM/height ² (male < 8.0586 kg/h ² female < 6.0359 kg/h ²)
Gómez-SanMiguel et al. [23]	In AiA rats, formoterol administration decreased severity of disease and skeletal muscle loss. It was associated with decreased inflammation, myostatin, the p-NF-κB(p65)/TNF pathway, IGFBP-3 and increased Akt and myogenin.	-
Yamada et al. [24]	According to an animal study of AiA rats, antioxidant treatment could prevent skeletal muscle dysfunction in RA patients.	-
Himori et al. [25]	According to an animal study of AiA rats, neuromuscular electrical stimulation could prevent skeletal muscle dysfunction in RA patients.	-
Fenton et al. [26]	In mice models of chronic polyarthritis, GC increased muscle wasting but reduced bone loss.	-
Yamada et al. [27]	GC use could promote sarcopenia in RA patients.	AWGS [12]
Risk		
Ngeuleu et al. [9]	Sarcopenia was associated with cardiometabolic risk in RA patients	SMI (Baumgartner et al. [10])
Torii et al. [15]	The incidence of falls, fractures, and lower bone mineral density were higher in patients with sarcopenia.	EWGSOP [16], AWGS [12]

	Mechanism	
Delgado-Frías et al. [28]	Sarcopenia in RA patients was associated with lower endothelial function.	SMI (Janssen et al. [4])
Roubenoff et al. [29]	Loss of body cell mass, high TNF- α and IL-1 were observed and cytokine production was associated with resting energy expenditure in RA patients.	-
Little et al. [30]	In AiA rabbits, reduction of muscle mass and diameter seem to be related with increased IL-1 β , NF- κ B, p38 MAPK signaling and seem to trigger anabolic compensation of increased myonuclei, Pax7, MyoD, myogenin and reduced pSTAT3, myostatin.	-
Visser et al. [31]	Higher plasma concentrations of IL-6 and TNF- α were associated with lower muscle mass and muscle strength.	-
de Oliveira Nunes Teixeira et al. [32]	In a CIA rat study, muscle atrophy was not associated with decreased mobility.	-
Castillero et al. [33]	In AiA rats, arthritis-induced skeletal muscle atrophy may be due to proteolysis resulting from increased IGFBP-5, IGFBP-3, atrogen-1 and MuRF-1 but not from a decrease in the myogenic regulatory factors.	-

LM, lean mass; FFMI, free fat mass index; SMI, skeletal muscle mass index; MMI, muscle mass index; RF, rheumatoid factor; CRP, C-reactive protein; BMI, body mass index; HAQ-DI, health assessment questionnaire disability index; MMP3, matrix metalloproteinase 3; ESR, erythrocyte sedimentation rate; ALM, appendicular lean mass; DMARD, disease-modifying antirheumatic drug; TCZ, tocilizumab; bDMARD, biologic disease-modifying antirheumatic drug; GC, glucocorticoid; AiA, adjuvant-induced arthritis; NF- κ B, nuclear factor kappa-light-chain-enhancer of activated B cells; TNF, tumor necrosis factor; IGFBP, insulin-like growth factor-binding protein; IL-1, interleukin-1; MAPK, mitogen-activated protein kinase; Pax7, paired box 7; pSTAT3, phospho-signal transducer and activator of transcription 3; IL-6, interleukin-6; CIA, collagen-induced arthritis; MuRF-1, muscle RING finger 1.

Table 2. Study Findings of Rheumatic Diseases Other Than Rheumatoid Arthritis and Sarcopenia.

Author	Findings	Definition of Sarcopenia
Spondyloarthritis		
El Maghraoui et al. [34]	Sarcopenia and pre-sarcopenia associated with high BASDAI and low BMD in AS patients.	EWGSOP [16]
Krajewska-Włodarczyk et al. [35]	Sarcopenia was associated with occurrence of osteoporosis in PsA patients.	SMI (Janssen et al. [36]), TUG>14s
Aguiar et al. [37]	SMI was correlated with BASDAI and BASFI in male patients.	SMI (Male: <10.75, Female: 6.75)
Systemic sclerosis		
Caimmi et al. [38]	Sarcopenia was associated with longer disease duration, worse DLCO/VA, lung and skin involvement (Medsker severity score).	SMI (Baumgartner et al. [10])
Siegert et al. [39]	Sarcopenic patients had lower physical function and more immunosuppressive drugs than non-sarcopenic patients.	EWGSOP [16]
Corallo et al. [40]	When defining sarcopenia according to SMI and HS separately, both were associated with malnutrition, disease duration, mRSS, capillaroscopy score, esophageal involvement, ESR and DLCO.	SMI (Baumgartner et al. [10]) or HS (Male: <30, Female:<20)
Pacini et al. [41]	Sarcopenia is positively correlated with overactive bladder.	SMI (Baumgartner et al. [10])
Justo et al. [42]	Female SSc patients had reduced muscle strength, endurance and it was correlated with physical disability.	-
Marighela et al. [43]	Longer disease duration was correlated with SMI.	SMI (Baumgartner et al. [10])
Doerfler et al. [44]	Medical nutrition therapy intervention reversed sarcopenia in GI involvement patients.	SMI (Baumgartner et al. [10])

BASDAI, Bath Ankylosing Spondylitis Disease Activity; BMD, bone mineral density; BASDFI, Bath Ankylosing Spondylitis Function Index; DLCO, diffusing capacity for carbon monoxide; VA, alveolar volume; mRSS, modified Rodnan Skin Score; GI, gastrointestinal.

Table 3. Study Findings of Inflammatory Bowel Disease and Sarcopenia.

Author	Findings	Definition of Sarcopenia
Inflammatory Bowel Disease (no separation into CD and UC)		
Adams et al. [45]	Sarcopenia is a predictor of need for surgery.	SMI (Prado et al. [46])
Bryant et al. [47]	SMI continuously decreased over time in newly diagnosed IBD patients, while sarcopenia did not.	SMI, HS (EWGSOP [16])
Pedersen et al. [48]	Sarcopenia is a predictor of postoperative complications in patients younger than 40 years.	Lowest sex quartile of TPI or HUAC.
Werkstetter et al. [49]	Pediatric IBD patients have lower lean body mass, muscle strength and reduced physical activity.	-
Crohn's Disease		
Mager et al. [50]	In children with IBD, sarcopenia is more prevalent in CD than UC. Sarcopenia is associated with suboptimal vitamin D levels (<50 nmol/l) in CD.	SMM z score<-2 [51]
Zhang et al. [52]	Sarcopenia is a predictor of major postoperative complications (grade \geq III on the Clavien-Dindo scale[53]).	SMI (Fearon et al. [54])
Bamba et al. [55]	Sarcopenia is a predictor of need for surgery.	SMI (Nishikawa et al. [56])
Thiberge et al. [57]	SMI was non-significantly lower in the group of patients needing surgery or dying during follow-up.	SMI (Mourtzakis et al. [58])
Lee et al. [59]	CRP was associated with sarcopenia and ESR, serum albumin, hemoglobin were correlated with SMI.	SMI (Kim et al. [60])
Cravo et al. [61]	Lower muscle attenuation was associated with severe phenotypes (stricturing or penetrating)	SMI (Martin et al. [62])
Carvalho et al. [63]	Sarcopenia is a predictor of postoperative complications.	SMI (Prado et al. [46])
Ding et al. [64]	Sarcopenia was associated with primary nonresponse to anti-TNF therapy	Lowest sex quartile of SMI.
Subramaniam et al. [65]	Infliximab increased muscle volume and strength.	-

Ulcerative Colitis		
Zhang et al. [66]	Sarcopenia was associated with high disease activity (high Mayo score) and colectomy reversed sarcopenia.	SMI (Fearon et al. [54])
Cusing et al. [67]	Sarcopenia is a predictor of need for medical rescue therapy or surgery in hospitalized ASUC patients.	SMI (Fearon et al. [54])
Fujikawa et al. [68]	Sarcopenia is a predictor of surgical site infection. Sarcopenia is associated with CRP.	Lowest sex quartile of TPI.

TPI, total psoas index; HUAC, Hounsfield unit average calculations; ASUC, acute severe ulcerative colitis.

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