M	model	dur.	% atrophy or force decline*	lipid per. & protein ox.	ROS produc.	antioxid. defense systems	protein synt. & degr.	A	reference
animals									
dia	MV, rat	18 h	15-30	↑LP, ↑PO			↑PD, ↑calp, ↑UP		(Shanely *et al.*, 2002)
dia	MV, rat	6, 12, 18 h					↓PS		(Shanely *et al.*, 2004)
dia	MV, rat	12 h			↑DCFH	↓GSH, ↓GPX, ↑HO-1, ↓SOD			(Falk *et al.*, 2006)
dia	MV, rat	12 h	~15*(force)			↓GSH ↓thiols	↑PD		(Betters *et al.*, 2004)
			=			↓GSH ↓thiols	=PD	tro	
dia	MV, rat	18 h	~40	↑PO		↓GSH	↑UP (MuRF-1 & atr-1)		(McClung *et al.*, 2007)
			~10	=PO		↓GSH	↑UP (MuRF-1 & atr-1)	tro	
dia	Mv, rat	12 h	~20-30 ~20*(force)	↑PO, ↑LP			↑calp, ↑casp		(Whidden *et al.*, 2010)
			=	no PO, no LP			=calp, =casp	tro	
sol	imm, rat	4, 8, 12 d	20-50 (rate)	↑LP (60%)		↑GSSX/GSH, ↑ Fe			(Kondo *et al.*, 1992)
		12 d	~35 (rate)	↑LP (20%)				vit E	

M	model	dur.	% atrophy or force decline*	lipid per. & protein ox.	ROS produc.	antioxid. defense systems	protein synt. & degr.	A	reference
sol	imm, rat	4, 8, 12 d	19-51			↑SOD, ↓MnSOD, =Se-GPX, =cat, ↑GST, ↑GSHRx, ↑XOD			(Kondo *et al.*, 1993)
sol	HU, rat	28 d	45		↑DCFH, ↑tot hydr	↑SOD, ↓MnSOD, ↓cat, ↓GPX, ↓ASC			(Lawler *et al.*, 2003)
sol	HU, rat	28 d	55		↑ tot hydr	↓GPX, ↓Hsp70, ↓Hsp25			(Lawler *et al.*, 2006)
sol	imm, rat	8 d	35			↓GSH (small)			(Appell *et al.*, 1997)
			12			=GSH		vit E	
sol & gas	HU	14 d	44 (sol) 30 (gas) 28* (force)	↑PO, ↑LP					(Koesterer *et al.*, 2002)
			~44 (sol) ~30 (gas) ~28* (force)	↑PO, ↑LP				vit E	
sol	HU, mice	12 d	44-38 64*(force)		↑ox act				(Matuszczak *et al.*, 2004)
			44-38 *force recovers					AI	
sol	HU, mice	12 d	~40		↑DCFH		=ser prot		(Arbogast *et al.*, 2007)
			~15		=DCFH		↓ser prot	BBIC	

M	model	dur.	% atrophy or force decline*	lipid per. & protein ox.	ROS produc.	antioxid. defense systems	protein synt. & degr.	A	reference
gas	HU, rat	5-10 d	~20	↑LP		↓GSH, ↑GSSG, ↓GSH/GSSG	↑UP		(Ikemoto *et al.*, 2002a)
			partial restoration	=LP		partial restoration of GSH, GSSH, GSH/GSSG,	=UP	cyst	
gas	HU, rat	2-21 d	~10	↑LP		↓GSH, ↑GSSG	↑UP		(Ikemoto *et al.*, 2002b)
			~10	↑LP		↓GSH, ↑GSSG	↑UP	vit E	
sol	HU, rat	14 d	49	↑LP		↓GSH/GSSG, ↑SOD, ↑GPX, ↑cat	↑casp-3-9, ↑atr-1, ↑MuRF-1		(Servais *et al.*, 2007)
			32	↓LP		↓GSH/GSSG, ↑SOD, ↑GPX, ↑cat	↓casp-3-9, ↓atr-1, ↓MuRF-1	vit E	
sol	HU, mice	14 d	22	↑LP, ↑PO		↑SOD, ↓CAH-III, ↓PRX-6, ↓Hsp_s			(Brocca *et al.*, 2010)
			22	=LP, =PO		↑SOD, ↑CAH-III, ↑PRX-6, ↑Hsp_s		tro	
gas	HU, rat	14 d	12	↑LP	=H_2O_2, ↑nitr	=SOD, =MnSod, =cat			(Siu *et al.*, 2008)
gas	HU, mice	14 d	10	=LP, =PO		↑SOD, ↑MnSOD, ↑PRX-6, ↑CAH-III			(Brocca *et al.*, 2010)
			10	=LP, ↓PO		↑*CAH-III, ↑*PRX-6, ↑*Hsp60		tro	

M	model	dur.	% atrophy or force decline*	lipid per. & protein ox.	ROS produc.	antioxid. defense systems	protein synt. & degr.	A	reference
humans									
dia	MV	1-69 h	53-57			↓GSH, ↑casp	↑UP (atr-1, MuRF-1)		(Levine *et al.*, 2008)
VL	BR	20 d	3-5				↑UP, ↑MuRF-1, ↑atr-1,		(Ogawa *et al.*, 2006)
VL	BR	7, 35 d	0-18	=PO (8d), ↑PO (35d)		↑HO-1 (8d), =HO-1 (35d), ↑Grp75 (8d), =Grp75 (35d)			(Dalla Libera *et al.*, 2009)
VL	ULLS	10, 23 d	5-10				↓PS, =mTor, ↓MuRF-1, ↓atr-1		(de Boer *et al.*, 2007)
VL	imm	2, 14 d	5-6	=LP, =PO		↑UPc (2d), =UPc (14d) =casp (2-14d)			(Glover *et al.*, 2010)

Table 1. Summary of the key literature cited related to muscle atrophy and oxidative stress in order of appearance. Only major findings per reference are reported. Antioxidant treatments have gray background. All symbols refer to comparison with controls, i.e. between disuse atrophy and controls or between disuse atrophy following treatment and controls.

Abbreviations:

↑= higher than control
↓= lower than control
= unchanged with respect to control
A= antioxidant treatment
Al = allopurinol
ASC= antioxidant scavenging capacity
atr-1= atrogin-1
BBIC= Bowman-Birk inhibitor
BR= bed rest
CAH=carbonic anhydrase
calp= calpain
casp= caspase
cat= catalase
cyst= cysteine
DCFH = dichlorofluorescin diacetate oxidation (index of ROS content)
dia= diaphragm
dur= duration
gas= gastrocnemius
GPX=glutathione peroxidase
Grp-75= glucose-regulated protein-75 or mitochondrial
GSH= glutatione
GSHRx= glutathione reductase
GST= glutathione S-transferase
HO-1=heme oxygenase-1, heat shock protein-70 or mortalin
HU=hindlimb unloading
imm= immobilization
lipid per. =lipid peroxidation
LP= lipid peroxidation
M= muscle
MV= mechanical ventilation
nitr= nitrothirosine content
ox act= oxidant activity
PD= protein degradation
PO= protein oxidation
protein ox.= protein oxidation
protein stynth & degr = protein synthesis and degradation
PRX=peroxiredoxin
PS= protein synthesis
ROS produc.= ROS production
ser prot= serine proteases
SOD= copper-zinc superoxide dismutase
sol= soleus
tot hydr= total hydroperoxides
tro= trolox
UP= ubiquitin proteasome activity
UPc= ubiquitin proteasome conjugates
VL= vastus lateralis
XOD= xanthine oxidase