

Exercise-Induced Modulation of Heat Shock Protein 70 (HSP70) Expression in Aging Populations: A Systematic Review



© GJSM 2026

OBJECTIVE

To summarize the effects of exercise on HSP70 expression and related inflammatory and oxidative stress pathways in adults ≥ 60 years. Aging impairs the HSP70 response; exercise may counteract this decline.

METHODS

- 13 studies (11 RCTs, 2 non-randomized)
- Adults ≥ 60 years; resistance, aerobic or combined exercise (8–24 weeks)
- HSP70 in PBMCs, serum/plasma or muscle; risk of bias (RoB2/Newcastle-Ottawa), certainty (GRADE)

KEY FINDINGS

- ✓ $\uparrow$ Intracellular HSP70 in PBMCs/muscle in 9/13 studies, supporting proteostasis and cellular stress resistance
- ✓ $\downarrow$ Extracellular HSP70 (eHSP70) and TLR/NF- κ B signaling in several trials, suggesting a shift away from a chronic pro-inflammatory state
- ✓ $\uparrow$ Antioxidant capacity (e.g., TAC, SOD) and $\downarrow$ oxidative stress markers (e.g., MDA)
- ✓ Overall evidence certainty: Low to Moderate, due to small sample sizes and heterogeneous protocols

AGING AND EXERCISE

Key Exercise Modalities: Resistance Training, Combined (Aerobic + Resistance) Training

HSP70 MODULATION

$\uparrow$ Intracellular HSP70
(Muscle / PBMCs)

$\downarrow$ Extracellular HSP70
(Serum / Plasma)

Molecular Chaperone $\rightarrow$
Facilitates protein folding &
prevents aggregation $\rightarrow$ Pro-
teostasis $\rightarrow$ Cellular Stress
Resistance & Survival

$\downarrow$ Acts as a Danger Signal
(DAMP) $\rightarrow$ Activates TLR/NF- κ B
 $\rightarrow$ Pro-inflammatory Response $\rightarrow$
Chronic Inflammation

HEALTHIER AGING

$\downarrow$ Chronic Inflammation (e.g., $\downarrow$ TNF- α , IL-6, CRP)
 $\downarrow$ Oxidative Stress (e.g., $\downarrow$ MDA, Protein Carbonyls)
 $\uparrow$ Antioxidant Defenses (e.g., $\uparrow$ TAC, SOD, GPx)
 $\uparrow$ Functional Performance (e.g., $\uparrow$ Muscle Strength, $\uparrow$ $\dot{V}O_2$ max)
Improved Metabolic Health (e.g., in older adults with metabolic syndrome or T2DM)

Note: 3/13 studies showed no significant change in HSP70, highlighting inter-individual variability and tissue-specific responses.

EVIDENCE FROM REVIEWED STUDIES

9 studies $\rightarrow$ $\uparrow$ HSP70 response
3 studies $\rightarrow$ no significant change
eHSP70 $\rightarrow$ variable response