Slide 1: BFR Training, Immune Activation & Stress Signals

Nielsen et al., J Physiol (2017) Blood Flow Restriction & Immune Enhancement

Slide 2: Background & Purpose

• Study tested if BFR training activates immune & stress responses • Compared BFR (20% 1RM + cuff) vs low-load (LLE) & high-load exercise (HLE) • Focus on: macrophages, heat shock proteins (HSPs), systemic damage markers

Slide 3: Key Findings: Macrophages

• M1 macrophages (pro-inflammatory) ↑ in both BFR & LLE • M2 macrophages (repair/anti-inflammatory) ↑ ~163% ONLY in BFR • Suggests BFR promotes a stronger repair-oriented immune response

Slide 4: Key Findings: Heat Shock Proteins

• HSP27 (protective protein) ↑ 60–132% during BFR training • HSPs support cellular resilience and adaptation • Indicates BFR creates a stress signal without lasting damage

Slide 5: Systemic Markers & Muscle Damage

• No major rise in creatine kinase (CK), IL-6, TNF-α, or MCP-1 • No evidence of overt muscle damage • BFR = adaptive stress without systemic inflammation

Slide 6: Interpretation

• BFR = controlled stressor → recruits macrophages & HSPs • M2 polarization = repair & remodeling → tissue adaptation • Immune/stress activation occurs without harmful muscle injury • Acts as a hormetic stimulus (small stress → big adaptation)

Slide 7: Student Takeaways

• BFR activates immune & stress pathways → adaptation, not damage • Increases both M1 & M2 macrophages, but favors repair (M2) • Boosts protective HSPs inside muscle • Provides sub-damaging stimulus for growth & recovery ➡ BFR = immune tuning + muscle adaptation