Exercise Therapy

www.physiotherapyphd.com

Define Resisted Exercise. Discuss in detail about the types of Resisted exercise and its uses.

Definition

Resisted exercise (also called resistance exercise or strength training) involves actively contracting muscles against an external load or force. In other words, the mover works against some form of resistance (body weight, free weights, machines, elastic bands, water resistance, etc.) during muscle contraction.

This resistance can be manual (a therapist or partner provides force) or mechanical (weights, springs, fluid in pistons, gravity, etc.). The goal is to improve muscle strength, power, and endurance (and ultimately function) by overloading the muscle beyond its usual demand.

Types of Resisted Exercise

Resisted exercises can be classified in mainly five types:

1. **Source of resistance:** Manual resistance (therapist or partner presses against the limb) versus mechanical resistance (external devices). For example, manual resisted exercises use a therapist's hands to provide resistance, while mechanical methods include dumbbells, weight machines, hydraulic or pneumatic machines, resistance bands, or aquatic equipment.
2. **Muscle contraction type:**
   Isometric: Muscle contracts without joint motion (the muscle length and joint angle remain constant). e.g. pushing against an immovable object or holding a plank.
   Isotonic (dynamic): Muscle changes length while moving a load. This includes concentric contraction (muscle shortens, e.g. lifting a weight) and eccentric contraction (muscle lengthens under load, e.g. lowering a weight).
   Isokinetic: Performed at a constant speed (using specialized machines that adjust resistance so the limb moves at a set velocity throughout the range). The resistance accommodates the changing leverage, allowing maximal muscle force throughout the motion.
3. **Kinetic chain (body segment movement):**
   Open-chain exercises: The distal segment (hand or foot) moves freely in space. These are usually single-joint or isolation movements (e.g. seated knee extensions, biceps curls). The distal limb is not fixed, so joints and muscles can be isolated.
   Closed-chain exercises: The distal segment is fixed (e.g. feet on the floor or hand on a bar), so movement occurs through multiple joints. These are typically weight-bearing compound movements (e.g. squats, push-ups). Closed-chain exercises tend to engage co-contractions and often mimic functional activities.
4. **Body position or environment:** e.g. upright weight-bearing (standing barbell squat) versus non-weight-bearing (lying leg press); land-based versus aquatic (water offers drag resistance).
5. **Modality:** e.g. elastic band exercises, suspension training, spring-loaded machines, and progressive vs. fixed resistance. (Often in rehab we also categorize "progressive resistive exercises" where the load is increased over time.)

Each category has its own advantages. For example, manual resistance allows tailoring to a patient without equipment, whereas machines and free weights allow quantifiable loads and

high intensity. Isometric exercises are useful when movement is contraindicated (e.g. in acute injury), whereas isotonic exercises improve both strength and joint motion.

USES OF RESISTED EXERCISES

Resisted (strength) exercises are widely used across many clinical and fitness settings to rehabilitate injuries, manage chronic diseases, and improve general health and function. Key therapeutic applications include:

1. **Musculoskeletal and Orthopedic Rehabilitation**

   Osteoarthritis (OA) and joint pain – Progressive resistance training strengthens periarticular muscles (e.g. quadriceps in knee OA), which unloads joints and reduces pain. A meta-analysis found that resistance exercise significantly improves pain, muscle strength and function in knee/hip OA. Clinical guidelines now list muscle strengthening as a core treatment in non-surgical OA management.

   Tendinopathies and soft-tissue injuries – Heavy slow resistance (HSR) protocols are standard for chronic tendinopathies (e.g. Achilles, patellar, rotator cuff), as they promote tendon remodeling and pain reduction. Likewise, after muscle strains or ligament sprains, graduated resisted loading (starting isometric) helps restore strength and tendon health.

   Fracture and post-surgical rehab – Once bone healing is adequate, resisted exercise helps restore muscle atrophy that occurs during immobilization. For example, early hip fracture programs include seated leg presses and hip abduction with bands to rebuild quadriceps/glutes. In postoperative orthopedic rehab (e.g. after knee or shoulder surgery), carefully progressed resistance training (often starting at low load, high reps) speeds recovery of strength and range.

   Low back pain – Core stabilization with resisted (often isometric) trunk exercises can reduce chronic back pain and improve function. Resisted lumbar extensions and abdominal bracing are commonly used to retrain spinal muscles. Strengthening the back and hip extensors supports the spine, reducing pain in many cases.

2. **Neurological Rehabilitation**

   Stroke – Post-stroke patients often have muscle weakness and impaired motor function. Resistance training (therapist-assisted or equipment) significantly improves muscle strength, motor control and functional outcomes after stroke. In fact, pooled data from 30 trials (over 1000 patients) showed resistance training yielded better gains in limb strength, motor function, independence and quality of life than usual care or other therapies. High-intensity leg-press and arm strengthening (often combined with task practice) are commonly used to regain walking ability and arm function.

   Spinal Cord Injury (SCI) and Neurodegenerative Diseases – In incomplete SCI or chronic conditions (e.g. multiple sclerosis, Parkinson's), resisted exercise helps counteract deconditioning and build muscle. For example, leg presses and arm ergometry can improve residual limb strength and ambulatory function in SCI. In Parkinson's disease, strength training (including resisted squats, leg extension) can improve bradykinesia and functional mobility.

   Cerebral Palsy and Developmental Disabilities – In children with CP or Down syndrome, carefully supervised resistance programs (using body weight, weighted vests, elastic bands) can increase muscle force and motor skills. Therapists use play-based resisted activities (e.g. pushing weighted objects) to improve gross motor function. Progressive loading has been shown to increase muscle cross-sectional area and strength even in these populations.

3. **Cardiovascular and Pulmonary Rehabilitation**

   Heart Failure and Coronary Artery Disease – Historically, aerobic training was emphasized, but recent evidence and guidelines highlight resistance training's role in

cardiac rehab. Systematic reviews show that in heart failure patients, resistance training safely improves muscular strength and cardiorespiratory fitness (VO2peak) and 6-minute walk distance, without harming heart function. In fact, when patients cannot do much aerobic work, pure strength training still yields meaningful improvements in exercise capacity and quality of life. Current cardiac rehab protocols often include 2–3 days/week of moderate-intensity weight training for the legs and arms.

Chronic Obstructive Pulmonary Disease (COPD) – COPD causes respiratory limitation and leg muscle wasting. Strength training of the limbs (e.g. seated leg press, arm curls with light weights) is an effective component of pulmonary rehab. A recent review concluded that resistance exercise is safe and improves exercise capacity, muscle strength, lung function, activities of daily living and quality of life in COPD patients. By increasing peripheral muscle mass, patients can walk and climb stairs with less dyspnea. Standard pulmonary rehab programs include both aerobic and resistance training for this reason.

4. **Metabolic and Chronic Disease Management**

Type 2 Diabetes and Metabolic Syndrome – Resistance exercise is a powerful tool for glycemic control and metabolic health. Increased muscle mass improves insulin sensitivity and glucose uptake. In diabetic patients, studies show regular strength training reduces HbA1c and helps manage body weight. When combined with diet, resistance training can significantly improve lipid profiles as well (raising HDL, lowering triglycerides). Many diabetes management programs now recommend ≥2 days/week of muscle-strengthening activities.

Chronic Kidney Disease (Dialysis Patients) – Maintenance hemodialysis often leads to severe muscle wasting and fatigue. Systematic evidence shows that resistance training is more effective than aerobic exercise for increasing muscle mass and strength in dialysis patients. Dialysis guidelines suggest incorporating leg and arm weight exercises (often done during dialysis or home-based) to prevent atrophy. Benefits seen include greater grip strength, improved physical function, and even better mood and quality of life. The renal nutrition and metabolism societies explicitly recommend exercise for all dialysis patients.

Obesity and Weight Management – In overweight or obese individuals, resistance exercise helps build lean mass (raising resting metabolism) and improves body composition. It also counteracts the loss of muscle that can occur with dieting. Strength training is often included in weight loss programs for these benefits.

Cancer Rehabilitation – Cancer therapies often cause muscle loss (cachexia). While research is evolving, growing evidence supports light-to-moderate resistance exercise (e.g. elastic bands, bodyweight, light weights) during and after chemotherapy. This helps maintain muscle mass, improve fatigue levels, and enhance recovery. Many oncology rehab protocols now include supervised strength training.

5. **Geriatric and Sarcopenia Prevention**

Aging and Frailty – Age-related sarcopenia (loss of muscle mass/strength) underlies many geriatric problems: falls, fractures, disability. Resistance training is the most effective intervention against sarcopenia. Even frail elders can gain strength and improve mobility through carefully dosed progressive loading. Studies show that high-intensity strengthening in seniors leads to significant gains in balance, walking speed, and independence. Public health guidelines for older adults (and position statements from sports medicine organizations) emphasize ≥2 non-consecutive days/week of resistance training for all healthy and frail elders alike.

Fall Prevention – By improving lower-limb strength and power, resisted exercises help seniors react to a loss of balance. Programs often include weighted sit-to-stands, step-

ups, and leg curls. Combined with balance and gait training, resistance exercise reduces fall risk. This is now a standard component of falls prevention interventions in older adults.

6. **Other Clinical Uses**

   Spinal Cord Rehabilitation – In incomplete SCI, bodyweight-supported squats and arm cranking with resistance can build residual strength. Such training can improve wheelchair propulsion power and transfers.

   Bone Health (Osteoporosis) – High-load, weight-bearing resisted exercises (e.g. weighted heel raises, chest presses) stimulate bone formation. Thus, resistance training is used to slow bone loss in osteoporotic patients (often combined with impact exercises).

   Neuromuscular Disorders (e.g. Muscular Dystrophy) – In some neuromuscular conditions, gentle resistance training (avoiding overwork) can help maintain strength. For example, low-intensity weight training is sometimes prescribed in early-stage Duchenne muscular dystrophy to prolong functional abilities (under close supervision).

   Chronic Pain and Rheumatologic Conditions – Beyond OA, resistance exercise is used in fibromyalgia (to improve pain coping and fitness) and rheumatoid arthritis (to strengthen joints and improve function, as tolerated). Graded strength programs can reduce disability in these conditions.

   Pregnancy and Postpartum – Moderate resistance exercises (e.g. pelvic floor exercises with resistance bands, core strengthening) are recommended in many prenatal programs to prepare for delivery and aid postpartum recovery, as long as no contraindications are present.

   Athletic Performance and Prevention – Although beyond "therapeutic" uses, resisted exercise is integral to sports training and injury prevention (e.g. strengthening hip abductors to prevent knee injuries). Preventive medicine also encourages strength training to reduce future risk of diabetes, hypertension, etc.

Reference: Kisner, Carolyn Therapeutic exercise: foundations and techniques / Carolyn Kisner, Lynn Allen Colby. — 5th ed.