

Muscle Building

Training to increase muscle strength, power, size (hypertrophy) or endurance is achieved through what is known as resistance training. Here are some important facts about resistance training that you should be aware of before you embark on a specific resistance training programme to suit your needs.

Benefits of resistance training

- Increase in muscle mass or toning depending upon intensity
- Increase in bone density with reduced risk of osteoporosis
- Increased strength of connective tissue and joint integrity
- Improved posture
- Reduced back pain
- Reduced blood pressure
- Reduced risk of diabetes

Types of resistance training

This resistance against which your muscles work can be provided by any of the following means:

- Free weights (for example, dumbbells)
- Resistance machines (for example, a chest press machine in the gym)
- Resistance bands
- Body weight (either partner resisted or more usually your own body weight, for example, press-ups)

Free weights vs. resistance machines vs. body weight

Resistance machines in many gyms although easy to use have many disadvantages: The plane of motion is set by the machine which is not always functional; they can limit normal range of motion; they tend to restrict the use of synergist and fixator muscles (these are all the many additional muscles that come into play to support the main muscle action); the seated positions do not replicate functional movements and they negate the use of core stabiliser muscles; and finally they are very expensive and cannot realistically be used unless you belong to a gym. Free weights and the use of body weight on the other hand replicate functional movements that can be performed to full range of motion with the use of synergists and fixators. Free weights are much less expensive than resistance machines and are portable. Of course the use of your own body weight is free! We, along with the [British Army Fitness Guides](#), would advocate free weights, bands and body weight for resistance training.

How to approach a resistance training session

Exercise order

You should always exercise larger muscle groups before smaller ones - for example, if you are doing an upper body workout and you exercise your triceps first, when you come to do a bench press your triceps, which assist your pectorals in this exercise, would be fatigued. As a result you would not get the full benefits of the bench press exercise. You should always exercise opposing muscle groups together - balance “pushing” exercises with “pulling” exercises. This will help you to develop muscle symmetry, avoiding strength imbalances that can lead to an increased risk of injury to ligaments and joints as a result of the abnormal stresses created. You should rotate through all the major muscle groups - upper body, core, lower body - leaving a 48 hour gap in between exercising any particular muscle group. This will ensure that you achieve a balanced regime as well as giving your muscles sufficient time to replenish glycogen stores and repair damaged muscle fibres.

Technique

Speed of contraction - as a general rule it is a good idea to take about two seconds during the contraction phase and four seconds during the relaxation phase. So for example, in a biceps curl exercise you would take 2 seconds to lift the dumbbells up to your shoulders and four seconds to lower them. At this controlled speed the risk of injury is minimal. If your principal fitness goal is power development then you may wish to increase the speed of contractions to one second and two seconds, but this is best done in consultation with a qualified fitness trainer. Range of movement - in general you should try to perform as full a range of movement in each exercise as possible that at the same time doesn't impose undue stress on ligaments and joints. You should also focus on doing each exercise as accurately and cleanly as possible without associated body movements that might reduce the effectiveness of the exercise. For example, during a biceps curl, bending the trunk forward to reduce the range of movement or swinging the arm at the bottom of the relaxation phase to give yourself a flying start for the contraction phase! When reaching the full extension of an exercise, it is alright to lock out the joint provided this is done in a slow, controlled fashion. However, if this is done at speed it can lead to injury.

Repetitions, sets and rest periods between sets

These are outlined in the [FITT guidelines](#) for each fitness goal. In general if you wish to develop muscle strength you should be aiming for high weight, low reps and a long rest period; for muscle power reps at a faster pace; for muscle hypertrophy medium weight, medium reps and medium rest period; and for muscle endurance low weight at high reps with a short rest period.

Frequency of training

This depends to a great extent on the balance between your motivation and time constraints. Programmes can range from a twice weekly 45 minute session for busy people through to 5 times a week for the dedicated enthusiast. The number of repetitions, sets and duration of rest periods should be adjusted according to your fitness goal as outlined in the [FITT guidelines](#). Remember that any fitness regime should also include cardiorespiratory sessions and not just resistance training. A sample 3 day a week regime is shown below covering upper body, core stability and lower body exercises.

Sample 3 Day a Week Regime

Monday: Upper Body

1. Warm-up phase:

- a. General dynamic mobility exercises involving the shoulders and neck.
- b. Initial pulse raising activity of jogging on the spot.
- c. Specific dynamic mobility exercises involving arm circles and trunk rotation.
- d. Final pulse raising activity; initial 20 reps of the exercises you intend to perform during the conditioning phase using a very light weight.

2. Conditioning phase exercises:

Free weight exercises - ideal for developing muscle strength, power and hypertrophy

Exercise	Equipment	Strength	Power	Hypertrophy	Endurance
Bench press	Dumbbell	1-3 RM 2-5 sets Speed x1 Rest interval 3-5 minutes	4-7 RM 2-3 sets Speed x2 Rest interval 5-8 minutes	8-12 RM 2-3 sets Speed x1 Rest interval 1-2 minutes	13-100 RM 1-3 sets Speed x1 Rest interval 30-60 seconds
Biceps curl	Dumbbell or barbell				
Shoulder press	Dumbbell				
Triceps extension	Dumbbell or barbell				
Chest flye	Dumbbell				
Single arm row	Dumbbell				
Standing flye	Dumbbell				
Triceps kick-back	Dumbbell				
Upright row	Dumbbell or barbell				
Lat pull down	Resistance band or machine				

Body weight exercises - ideal for developing muscle endurance

- Press-ups
 - normal position
 - narrow position for greater emphasis on triceps and back muscle development
 - wide position for greater emphasis on chest muscle development

The following table will guide you as to your performance for normal position regular press-ups that can be achieved in 2 minutes. Aim to achieve very good or excellent rep numbers if you want to develop long-term muscle endurance.

Age	under 30		30-34		35-39		40-44		45-49	
Gender	Male	Female	M	F	M	F	M	F	M	F
Excellent	72+	46+	70+	41+	68+	37+	62+	33+	55+	31+
Very good	53-71	30-45	51-69	26-40	50-67	23-36	44-61	22-32	38-54	20-30
Good	44-52	21-29	41-50	19-25	39-49	16-22	35-43	15-21	29-37	13-19
Average	34-43	14-20	32-40	12-18	30-38	11-15	27-34	10-14	21-28	6-12
Poor	0-33	0-13	0-31	0-11	0-29	0-10	0-26	0-9	0-20	0-5

- Incline press-up
- Decline press-up
- Pull-ups
- Dips
- Triceps dips
- Double dips

Although these body weight exercises tend themselves to endurance goal, if your wish to develop strength or hypertrophy you can still use these exercises by making them more difficult by attaching a weighted Powerbag that has the effect of increasing the resistance and reducing your RM to the desired level. *Plyometric exercises for power development* Once you have developed a sufficient strength base, if you wish to develop power further then you could include plyometric training in your workout. The term plyometric is derived from the Greek meaning “changing length” and is defined as rapid eccentric loading (muscle contraction whilst lengthening) followed by a brief isometric phase (muscle contraction against static resistance) and explosive rebound using stored elastic energy and powerful concentric contractions (muscle contraction whilst shortening). Catching a heavy medicine ball and throwing it back to a partner would be a good example of a plyometric exercise. Some examples of upper body plyometric exercises are listed below:

- Clap push-ups
- Incline push-up depth jump
- Chest pass
- Incline chest pass
- Power drop
- Rotation throws

3. Cool-down phase

Perform the following static stretches: neck, chest, back and shoulders, shoulder, triceps, forearm and wrist.

4. Post-workout nutrition

In addition to hydration and carbohydrate replenishment as outlined in the section on cardiorespiratory endurance, if your goal is muscle strength, power or hypertrophy then you should consume a protein rich supplement which may also include creatine immediately following exercise to maximise gains from your workout. Even if your goal is endurance, you should consume adequate protein as during endurance training once muscle glycogen is

depleted, energy production can switch to protein breakdown. Guidelines for recommended daily protein intake for different fitness goals are shown below:

Fitness goal	Daily protein requirement per kg body weight (g)
Muscle strength and power	1.4 - 1.8
Muscle hypertrophy	1.8 - 2.0
Endurance	1.2 - 1.4

Wednesday: Core Stability

1. Warm-up phase:

- a. General dynamic mobility exercises involving the trunk and hips.
- b. Initial pulse raising activity of jogging on the spot.
- c. Specific dynamic mobility exercises involving trunk rotation, hump and slump, and lying twist.

2. Conditioning phase exercises:

Exercises for developing core stability largely involve the use of body weight exercises. Perform these exercises - unless otherwise indicated - using the appropriate number of reps, sets and rest intervals for your fitness goal. Many of the exercises can be made harder using weights to adjust your RM to the appropriate level for your goal. For example, sit-ups can be performed whilst holding a weight over the chest with your arms.

- Sit-ups (in ascending order of difficulty)
 - half-sit-up
 - anchored sit-up
 - twist sit-up
 - crunch
 - seated leg extension

The following table indicates the number of anchored sit-ups you should be able to perform within a 2-minute period. If your goal is long-term endurance, aim for very good or excellent performance.

Age	under 30	30-34	35-39	40-44	45-49
Excellent	77+	72+	71+	67+	62+
Very good	59-76	55-71	52-70	47-66	43-61
Good	50-58	46-54	43-51	37-46	34-42
Average	40-49	38-45	33-42	27-36	25-33
Poor	0-39	0-37	0-32	0-26	0-24

- Plank exercises (only perform each exercise 3 times)
 - full plank (or modified version if you find this too difficult)
 - side plank
 - supine plank

- Lateral flexion with dumbbells
- Lower back exercises
 - dorsal raise
 - superman
 - bridge
 - bridge with leg extension

- Swiss ball exercises
 - ball balance on knees (do just once but hold the position for as long as you can)
 - sit-up on ball
 - back extension on ball
 - pike on ball

Make sure you choose the correct size of Swiss ball for your height. The following table will guide you as to what size to choose:

Height	Swiss ball size
5 ft - 5 ft 5 in	55 cm
5 ft 6 in - 6 ft 1 in	65 cm
6 ft 2 in - 6 ft 8 in	75 cm

3. Cool-down phase

Perform the following static stretches: side stretch, lower back stretch and the modified cobra.

4. Post-workout nutrition - as for Monday's regime.

Friday: Lower Body

1. Warm-up phase:

- a. General dynamic mobility exercises involving the trunk, hips, knees and ankles.
- b. Initial pulse raising activity of jogging on the spot.
- c. Specific dynamic mobility exercises involving 8 repetitions of controlled leg swings, heels-to-bum, hip rotation, knee-to-front and walk-on-toes.
- d. Final pulse raising activity of jogging at a faster rate.

2. Conditioning phase exercises:

All of the following exercises can be performed using body weight especially if your goal is endurance. Most of them can also be made more difficult by using dumbbells, Powerbags, medicine balls or resistance bands if your goal is strength, power or hypertrophy. For example, squats can be performed using just body weight, or by holding dumbbells in each hand, or by holding a barbell, or by holding a Powerbag, or by attaching resistance bands to both feet and holding each end above the shoulder. Remember that some of these exercises involve picking up heavy objects from the floor, so in order to protect your back you should stand close to the object you intend to lift, bend your legs to reach it without bending your waist forward and then to push straight up using your legs.

- Squats
 - standard squat (with or without weights)
 - one-legged squat (with or without weights)
 - squat jump
 - squat thrust
 - squat thrust with single legs

- Lunges
 - stationary lunge (with or without weights)
 - forward lunge (with or without weights)
 - backward lunge (with or without weights)
 - lunge jump

- Burpees
 - basic burpee
 - burpee with press-up and jump

- Step-ups
 - standard step-up (with or without weights)
 - step-up with knee raise (with or without weights)

- Calf-raises
 - calf-raise from floor (with or without weights)
 - calf-raise from step (with or without weights)

- Hamstring exercises
 - supine hamstring curl on Swiss ball
 - prone hamstring curl with medicine ball

Once you have developed a sufficient strength base, if you wish to develop power further then you could include plyometric training in your workout. Some examples of lower body plyometric exercises are listed below:

- Tuck jumps
- Broad jumps
- Bunny hops
- Hurdle jumps
- Multiple hops
- Alternate foot bounds
- Box jumps
- Depth jumps

3. Cool-down phase

Perform the following static stretches: calf, quadriceps, hamstring, hip flexor, groin and gluteal.

4. Post-workout nutrition - as for Monday's regime.