



How to build muscle

What is muscle hypertrophy?

Hypertrophy is an increase in the size of tissue or organ due to growth of individual cells, without an increase in the number of cells (Kent, 2006). The following are different forms of hypertrophy:

First of all you will have the 'pump', **muscle pumping** is a temporary increase in muscle size during a single bout of exercise. The size increase results mainly from fluid accumulation in the interstitial and intracellular spaces of muscles (Kent, 2006). Constant training leads to **chronic hypertrophy**, which is a relatively permanent increase in muscle size, in contrast to a temporary increase due, for example, to muscle pumping. Chronic hypertrophy results from resistance training that is repeated over a long period (Kent, 2006). **Hyperplasia** is another form of muscle hypertrophy, this is an increase in the number of cells. The number of cells may increase by longitudinal splitting as a result of regular resistance training: this may contribute to an increase in muscle size (Kent, 2006).

Before you get excited about how you can increase your muscle size, we need to make a few things clear. Your potential to build muscle will depend on your muscle fibre density, genetics, training history, age, testosterone, growth hormone, nutrition, recovery and training.

With resistance training there are a few things which need to be considered – intensity, repetitions, sets, volume, rest intervals, muscle failure and speed of movement. All of these factors manipulated into a strategically well-balanced training plan contribute to the primary factors of hypertrophy, which are mechanical tension, muscle damage and metabolic stress. The following paragraphs look at the variables mentioned and how you should adhere to them in your training.

Before taking your first step towards muscle hypertrophy it is important to take into consideration the “Strength Training Pyramid” from Eric Helms. You can see before manipulating sets, reps, tempo and volume you should have a solid

foundation in place – sleep, hydration, nutrition and adherence. If you are going to the gym sporadically to just train, but if on the other hand you have been going to the gym for a few months and regularly attending 3 times a week then start to build on your foundation.



Variables to training

Sets and Repetitions – a repetition is the number of times you perform a specific exercise – if you performed 10 squats this would be 10 repetitions. A set is the number of times you perform 10 repetitions. If you completed 10 repetitions on a squat that would make 1 set. How many sets should you do? Research by Krieger (2010) showed multiple sets of resistance training to be more beneficial than one set. Krieger (2010) compared 1 set against 2-3 sets and 4-6 sets. The analysis showed a 40% greater hypertrophy related effect size for multiple

sets compared to single sets. How did 2-3 sets compare to 4-6 sets? Krieger (2010) reported no significant difference between 2-3 sets and 4-6 sets for muscle hypertrophy.

Aim for 12-20 sets per muscle group per week. This equates to 4 sets per muscle group each workout if completing three sessions a week. The target of 12-20 sets per muscle group can be split in a number of ways – split routines, push/pull days and full body workouts are just a few examples. Which routine you do depends on the amount of times you will come to the gym. If you come to the gym once per week that is a lot of work to carry out per muscle group!

Intensity – intensity is expressed as the percentage of your 1 repetition maximum (RM). For example, written as 60% of 1RM. This allows programs to be specific to an individual, because at certain percentage of your 1RM you should be able to perform a certain number of repetitions. For example, at 75% of your 1RM you should be able to reach 10 repetitions.

To work out your one repetition max Body Happy recommends performing sub-maximal testing. Start with a few warm up sets before you test. For example:

Rest 2 min between sets	Repetitions Could Get	Repetitions Complete
Set 1	10	7-8
Set 2	8	5-6
Set 3	6	3-4
Set 4	?	As Many Repetitions As Possible

Make a note of how many repetitions you completed and the weight used. In-put these into the Body Happy 1RM calculator to calculate work your 1 Rep Max.

Volume = number of repetitions x load (weight) x sets. For example, 3 sets of 10 repetitions with 50kg would mean a volume 1500kg (10 reps x 50kg = 500kg x 3 sets = 1500kg) for that one exercise. Why multiple sets? Simply high volume; multiple sets have consistently been reported to be superior to single sets for hypertrophy.

This is because they allow for a greater volume. As previously mentioned 2-3 sets are better than 1 set.

Overload – both volume and intensity help achieve the overload principle. Is the intensity of the exercise higher than normal to create a physiological adaptation? The body adapts when the muscles are taxed to a point where they have to grow stronger to lift the weight. If you train with 3 sets of 10 repetitions using 40kg, the following week you should try to increase to 3 sets of 10 repetitions on 41kg, meaning an increase in intensity and volume (1200kg to 1230kg). The body responds by growing the muscle fibres to grow stronger and sometimes bigger, ready to handle the extra load. At some point you may reach a plateau where you do not adapt, this is where you may start playing around with some of the other variables to overcome this plateau.

Rest Intervals – this is the time you take between sets, to rest. It can either be short (0-30s), moderate (60-90s) or long (3 minutes plus). The optimal range for hypertrophy is 60-90s, this is because it allows for the majority of a person's strength capacity to be recovered – which improves consistently, the more you train with less rest – allowing you to lift at a higher percentage of your 1RM throughout your training. Resting longer (3 minutes plus) is ideal for strength trainers or powerlifters as full recovery occurs and short rest (0-30s) is not sufficient enough for recovery, but may be used for rest in a cluster set.

Muscle Failure – this is seen as a point in a set at which you can no longer complete the full range of movement – I see muscle failure when someone assists you lifting the weight. It is reported that training to failure does gain hypertrophy benefits. The problem with training this way is the increased potential to over-train and psychological burnout. For a safe and effective way increase the volume and intensity over a number of weeks, see the plan below for this.

Time Under Tension– this is the speed at which you carry out the exercise. For hypertrophy you are need to have the muscle working for 40-60 seconds. When completing a set of 10 reps you take 4 seconds per repetition – 2 seconds to lower the weight and 2 seconds to lift the weight.

Research has shown that the concentric (lifting the weight) part of the lift can be the faster part of the repetition – and still provide hypertrophy benefits. The speed of movement is far more important for the eccentric portion of the lift (lowering the weight) – eccentric actions are proven to have the best effect on muscle hypertrophy. When lowering the weight, we have more control because

we are stronger in the eccentric phase of a lift than we are concentrically, so you have no excuses not to keep the movement controlled.

How does all this add up?

All training goals have previously been loosely grouped together – if we are after strength training then we should do training in the 1-5 rep repetition zone, hypertrophy 6-12 reps and endurance 13+ reps. Previous research had shown 6-12 reps to be the most inferior way for eliciting muscle hypertrophy when compared to Low (1-5 / 100-87% 1RM) and High (15+ / < 65% 1RM).

New research by Brad Schoenfeld (2014) is showing that low loads can produce hypertrophy in young resistance trained men, further studies would be needed on adolescents, women and older populations to see if these results carry over. In the Schoenfeld study, the low load group completed 3 sets of 25-35 repetitions per set, at between 30-50% 1RM and the high load 3 sets of 8-12 repetitions per set, at 70-80% 1RM all sets to failure. Exercises in the study consisted of flat barbell press, barbell military press, wide grip lat pulldown, seated cable row, barbell back squat, machine leg press and machine leg extension. Both groups increased muscle thickness in the elbow flexors (5.3% and 8.6%), elbow extensors (6% and 5.2%) and quadricep femoris (9.3% and 9.5%) during the three training sessions a week study over 8 weeks. Not surprisingly the results also showed the high load group significantly improved maximal strength more than the low load group and the low load group showed significant increases in muscle endurance tests compared to the high load group – you will always get what you train with.

Research by Ogasawara (2013) also found low load resistance training to be beneficial in increasing muscle size. Ogasawara et al. (2013) compared 3×10 sets at 75% 1RM to 4 sets at of as many reps as possible at 30% 1RM to muscle failure in the bench press, 3 sessions per week. They also found that although the low load group increased muscle size, the increase in strength was not as high as the high load group – again, specific adaptations to the training performed and considerations for you depending on your training goal.

The moderate to long repetition ranges are more beneficial to hypertrophy due to the effects on the chemical makeup of the muscles – ATP, creatine phosphate,

glycogen, testosterone and growth hormone. The moderate repetition range also meets a greater time under tension, compared to low repetition, resulting in microtraumas and fatiguing all muscle fibres (fast and slow twitch). For example, your muscle could be under tension for 60 seconds when performing a set of 20 repetitions compared to 15sec for a set of 5.

If you are training for hypertrophy you need to consider your training history – are you new to lifting or have you been training for a number of years? If you are new to training then simply lifting a weight and working out will lead to hypertrophy, this is where the standard 3 set of 10 repetitions came from. As you train for longer the variables mentioned in this article come into play a lot more – refer back to the ‘Muscle and Strength Training Pyramid’ by Eric Helms. The first part of training is adherence, if you get into a routine, then gains will come. Once you have a schedule in place and being following for a number of months, you can then start to build on this. You then end up playing around with the number of sets, number of repetitions, rest intervals, load used.

How does this build into an exercise routine?

Plan A

Week One	Week Two	Week Three	Week Four
3 x 8 @ 79%	3 x 10 @ 75%	3 x 12 @ 71%	3 x 15 @ 67%

Plan B

Week One	Week Two	Week Three	Week Four
3 x 10 @ 75%	3 x 15 @ 71%	4 x 8 @ 77%	4 x 12 @ 73%

*Once you have completed all four weeks you can cycle back through starting with heavier weights, as you should have adapted so if on Plan A you performed 3 set of 8 reps with 40kg you could be on 3 sets of 8 reps with 45kg come week 5 if cycling through Plan A again.

Perform any core, corrective or mobility exercises whilst resting between exercise or at the end of the session .

If you were on a three-day routine you would carry out 3-4 sets per muscle group each workout to reach the recommended 12-20 sets per muscle groups. You would also want to hit the muscle from a variety of angles so the exercise each session may vary.

Recommendations for hypertrophy – record, record, record! Whether through a note pad and pen or in a spreadsheet: keep a note of everything. This way you can see how you are manipulating your volume and track your progress. This prevents getting stuck and lifting the same weight every session – because you can't remember how many sets and reps or even the weight from the week before. By recording your sessions, you know what you achieved previously, and where you need to start this session, using the warm up sets to build up to the weight you are using for your work sets.

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