The top 15 resistance exercises from Peak Performance

PEAK PERFORMANCE
The research newsletter on stamina, strength and fitness

Welcome to PP,

As a new subscriber you're no doubt in a hurry to get out of the blocks on the 'B of the bang' armed with the new training methods and theories that PP will bring to you. Written by an array of experts, top-level coaches, sports psychologists, nutritionists and physiologists, PP is all about providing athlete and coach with understandable and practical sports training information - information that will allow you to achieve winning, and personal best breaking, performances.

In this special report you'll find 15 resistance exercises from our regular 'Exercise of the Month' feature in *Peak Performance* designed to develop power, strength, speed, endurance and flexibility. Our team have carefully analysed the movement patterns and muscular actions involved in each. This will provide you with the information needed to get the most out of each for general and specific sports enhancing purposes. We have also provided numerous sports-specific variations and progressions for the exercises. Enhancing sports performance is all about getting as close a conditioning match as possible between what you do in training and what you in competition - these exercises and their progressions will do just this.

John Shepherd

John Shepherd MA is a specialist health, sport and fitness writer and a former international long jumper

Warning

The author and *PP* take no responsibility for injuries caused by attempting these exercises. *PP* recommends that you always learn new exercises under the guidance of a professional.

Pre-amble to body weight exercises

Using the resistance offered by your body to enhance sports performance provides a myriad of opportunities. The exercises in this section include those designed to enhance flexibility (downward dog) to those designed to develop strength and muscular endurance (press-up) to those that enhance strength and will boost running performance (single-leg squat).

The ab curl-up

Just because this is one of the most commonly-performed trunk exercises don't be fooled into thinking it's easy. Poor technique compromises the effectiveness of the exercise, so it is worth checking that you are able to do it perfectly.

Muscles involved: Rectus abdominis, obliques.

Benefits: An effective exercise for recruiting the rectus abdominis muscle and increasing its general strength.

Functional anatomy: The curl-up involves flexion of the thoracic portion of the spine to lift the weight of the shoulders and head off the floor, using the rectus abdominis assisted by the obliques. The lumbar spine remains fixed during the movement. For optimum benefit it is important to ensure that the shoulders and neck do not assist the abdominals. Do not place any undue strain on the neck or low back structures.

Who should do it: Everybody, but particularly those needing to strenghten their stomach muscles. It can be used as part of a workout for whole body, or core, strength.

Start position (above right)

- Lie on your back, with knees bent and feet comfortably flat on the floor;
- Adjust your pelvis so that your lumbar spine is in the neutral position. You should feel a slight gap between your back and the floor;
- Curl up your head and bring your chin towards your chest, fixing your neck position as if you were holding an apple between your chin and neck;
- Place your hands to your ears and fix your arms open with your elbows pointing out to the side.

Curl-up movement (below right)

- Slowly, focusing on your abdominals, curl your upper back off the floor. Do not move any other body part and keep your arms, shoulders, neck and legs relaxed as the abs pull you up. If the movement is performed correctly, your head and arms will curl up as one unit with your shoulders;
- Stop once your upper back is off the floor. Do not tilt your pelvis or pull with your thighs to lift yourself any higher;
- Pause for one count at the top.

Return movement

- Slowly, again focusing on the abdominals, lower your upper back down to the floor;
- Do not move your head or arms as you return to the start position.

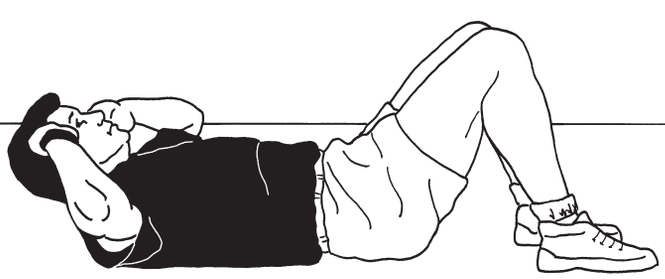
Training tips

By eliminating any arm and head movements, you make this exercise significantly more difficult. Once you have perfected this strict technique, you may need to add weight for progression. Try holding a dumbbell behind your head (again ensuring you do not lift with your arms) to add weight to the curl-up.

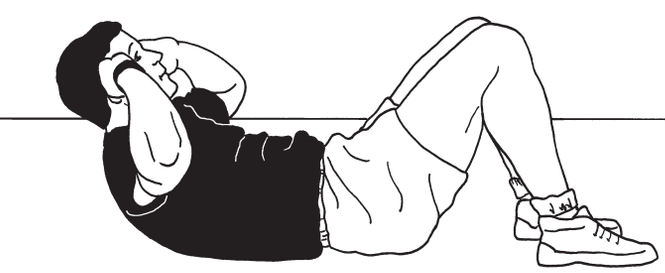
Raphael Brandon MSc is a sports conditioning and fitness specialist. He is also London Region Strength and Conditioning Coach for the English Institute of Sport

'By eliminating any arm and head movements, you make this exercise significantly more difficult'

The start position



The curl-up movement



Press-ups

***PP* regular James Marshall takes a fresh look at one of the old favourites – press-ups. As James explains, recent research indicates that the press-up action can – and should – be tailored to the requirements of your sport**

It may seem strange to feature such a common exercise as press-ups in 'exercise of the month' – after all, who has never done a press-up at some point in their life? However, because they are so common, researchers like analysing exactly what they do, and in particular, which muscles they benefit the most. Anecdotal evidence suggests that varying the hand position in the exercise alters the intensity and proportion of the involvement of the muscles used, and recent research has confirmed this.

The two main muscle groups involved are the triceps of the rear upper arm and the pectoralis major of the chest. The triceps is the prime mover in extension (straightening) of the elbow; the pectoralis major is the prime mover in adduction of the humerus (moving the upper arm towards the mid line of your body).

The press-up action also requires the trunk to remain in a fixed position relative to the upper body; this stabilisation action uses the trunk muscles including the psoas, rectus abdominus, transverse abdominus of the frontal trunk and the erector spinae of the rear trunk.

Hand width and position variations

Recent studies using electromyography (measuring the electric recruitment of muscle fibres) have shown that a narrower than shoulder-width hand position requires more triceps work than the shoulder-width and wider than shoulder-width hand positions and it also results in greater pectoralis (chest) involvement *per repetition* performed (contrary to popular opinion)[1].

Researchers have also recently studied force generation during six variations of press-ups; the three already mentioned, as well as kneeling press-ups, anterior (with the arms forwards of the body) and posterior (with the arms underneath the body towards the waist)[2]. In this case, they found no significant differences in patterns of force generation in any of the variations except for the posterior position, where the pectoralis muscle was used more. The kneeling variant did however produce less force (53% of the body weight of the subject compared to 66% in the other variations).

Benefits and progressions

Assuming that you are injury free, think about why you may want to do this exercise. The hand position you adopt should replicate the most common practice in your sport; if you use a variety of hand positions, then do the same with the press-ups; if you want to get the most time-efficient workout, you should adopt the narrow hand position. If you want to emphasise different aspects of your upper body strength you can look at a few of the following ideas:

- If you are returning from injury and are not confident in the above variations, start by trying the exercise standing up and leaning against a wall. You can then progress to the kneeling position, as this requires less effort than the standard press-up;
- To develop shoulder stability, try with one hand on a medicine ball and one hand on the floor. This requires the rotator cuff muscles to work harder on keeping the correct shoulder blade position;
- To develop trunk stability, try with either one foot off the floor, or with both feet on a stability ball. This will also push more of your body weight into the arms, so it will also require greater strength;
- 'Contact development' – useful for sports that involve falling to the floor, such as rugby. Start by kneeling upright and then fall forward and perform a controlled kneeling press-up to the floor. Progress to standing, then walking forward and dropping to the floor.

Once a sound strength base has been established, you can work on developing power. Try the kneeling press-ups, but push straight back to the upright kneeling position again. Try to have as little time close to the floor as is possible. Other variations include the clap press-up with hands either clapping together after you have pushed up off the floor powerfully, or both hands touching the chest.

James Marshall MSc, CSCS, ACSM/HFI runs Excelsior, a sports training company

The narrow press

The wide press

The posterior press

Press-up positions

Shoulder-width – the normal position, with the hands placed directly underneath the shoulders. Keeping the body in a straight line between heels and head, lower your chest to the floor and then push up until the arms are straight.

Narrow base – same as normal, but place your hands together on the floor, with the two sets of thumbs and index fingers touching each other, forming a triangle, with the thumbs as the base.

Wide base – same as normal, but place your hands outside of the line of your body at twice the width of your shoulders.

Posterior – same as normal, but place your hands about 20cm further towards your hips.

Kneeling – same as normal, but place your knees on the floor, lower your nose to just in front of the line of your hands and return to the start position.

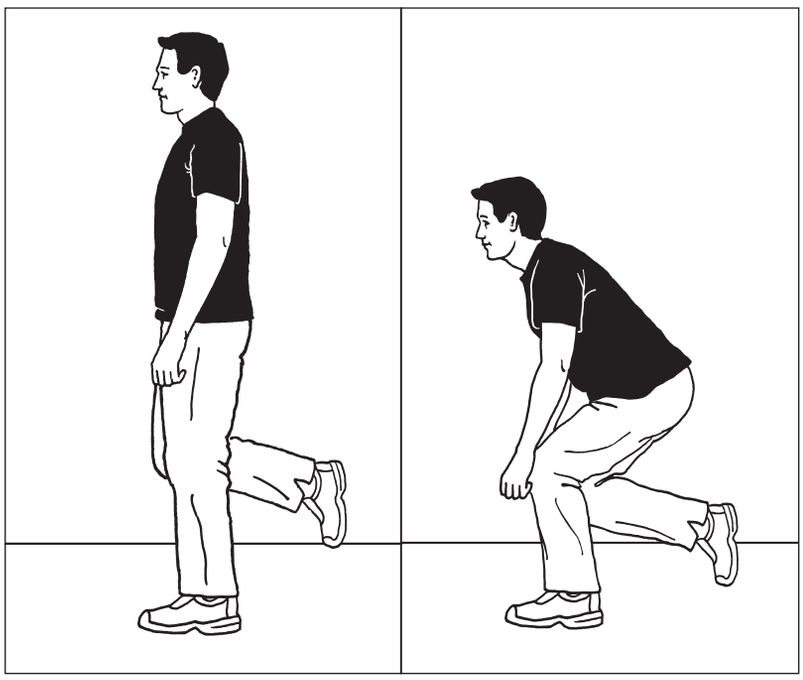
References

1. J Strength and Conditioning Res 2005; 19:3, 628-633

2. J Strength and Conditioning Res 2005; 19:1, 146-151

Single-leg squat

Muscles involved: gluteus, hamstrings, quadriceps and core (back and stomach muscles).
Joint motion: hip extension, knee extension.
Sports applicability: All sports, particularly running.



Conditioning benefits

● *General*. The single-leg squat makes a useful alternative to the barbell squat. Indeed, it could be argued that the emphasis between the two exercises should be the other way round, with the barbell squat being a great alternative to the single-leg squat. Even without added weight, the exercise develops real strength. And if weight is added, because this does not have to be supported through the back, there is little danger of back injury (*see variation, below*);
● *Sport specific*. This is one of the most effective sport specific resistance conditioning exercises available. Most sport skills are performed with an alternate/independent leg action – running being the obvious example – and the single-leg squat develops this independent strength. This will:
⁕ Develop more symmetrical leg strength;
⁕ Integrate the core (abdominal and back muscles) into the movement in a way that is highly complimentary to sport performance. During the execution of many sport skills (as with the single-leg squat) the core muscles act to 'brace' performers to hold them firm, allowing for the optimum expression of power without wasteful lateral movements;
⁕ Develop balance (because the movement is performed from one leg).

Start position (above left)

● Stand straight, with your body weight supported on your left foot, which should be flat on the floor. Tuck your right heel up behind you, with your lower leg roughly parallel to the ground and your right knee aligned with the left. Balance;
● Look straight ahead and don't arch or curve your back but maintain neutral spine position;
● Keep arms by your sides.

Action (above right)

● Flex your knees and hips to 'drop' your buttocks towards the floor. Keep your chest lifted;
● Lower to the point where it becomes difficult to maintain your balance, pause and flex your knees and hips to return to the start position. Make sure you do this in a controlled fashion. Perform 8 reps then change legs.
To prevent knee injury:
⁕ Ensure that your knee hinges in a straight line, with lateral movement kept to a minimum;
⁕ Make sure your knee does not travel beyond your toes when lowering and rising;
⁕ Don't lock your knee out – *ie* completely straighten it – at the top of the movement.

Training tips

To aid balance you may 'dab' the floor with your unsupported foot. Fixing your gaze straight ahead and really focusing on the dynamics of the exercise will serve a similar purpose.

Start with 3 x 8 reps on each side, to a one-up, two-down count, with a one-minute recovery between sets. Once you can perform this number of reps with little wobbling from either leg, you are ready to progress to the following variation.

Variation

Single-leg squat with hold. Assume the same starting position as above, but this time lower only to a three quarter squat position (with your upper thigh at an angle of about 45° to the ground). Hold your balance for 10 seconds and then push back up to the starting position. The interim (hopefully!) static position will really focus your mind and muscles on stabilisation, and this will strengthen your muscles and joints in a way that will help to prevent sports injuries as well as improve performance. Perform three sets of 10 reps on each leg, alternating between right and left leg.

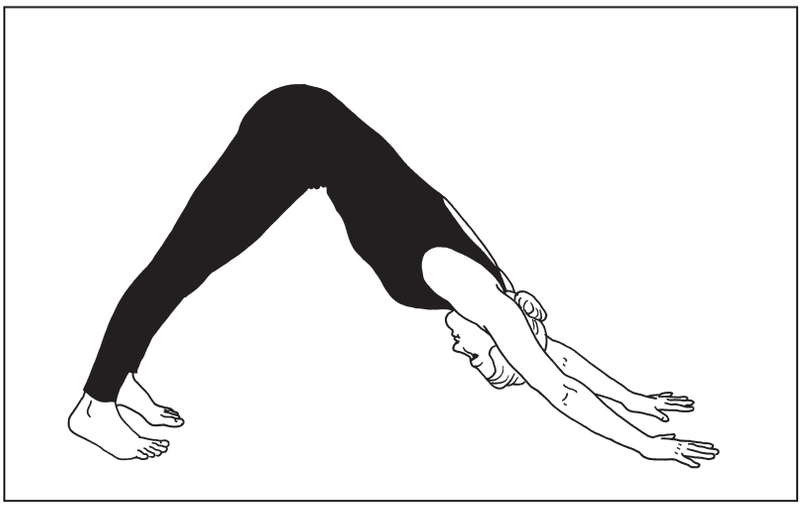
Once you can perform these two single-leg squat exercises with ease, you can add to their difficulty in numerous ways. For example, you could hold a medicine ball on your chest, or over your head, or hold dumbbells by your sides while performing the exercises. You could even progress to performing any of these variations from an unstable surface, such as a wobble board, to really improve your balance and proprioceptive ability!

John Shepherd

'One of the most effective sport specific resistance conditioning exercises available'

Downward dog

The downward dog is one of the most widely recognised yoga poses and has much to offer any athlete, especially those involved in running or high-impact sports, where tight hamstrings and spinal tension can impede performance. However, as well as stretching and strengthening the body, this pose can also be used to rejuvenate and invigorate the body, as part of your warm-up and cool-down, and for recovery between training sessions.



Benefits

- Lengthens and releases tension in the spine;
- Releases tension around the shoulder blades;
- Stretches the hamstrings of the rear thigh, gastrocnemius muscle of the calf, and the hands;
- Strengthens the ankles, frontal thighs, shoulders, arms, wrists and the core muscles of the trunk;
- Anecdotal evidence suggests that the pose can improve digestion, relieve back pain and fatigue, and some athletes report that it can also help to calm the mind and relieve stress.

Step by step

1. Start by kneeling on your hands and knees on a non-slip surface, without socks. Place your hands shoulder width apart, a little further forwards than your shoulders and your knees underneath your hips. On an inhalation, lift your hips up towards the roof and, on an exhalation, lower your heels gently towards the floor, straightening out your legs.

2. Check that your fingers are spread apart and the middle fingers face forwards. Press your weight firmly through the inner wrist, base of the thumb and forefinger. Spread your weight evenly through your hands and feet and move your chest towards your thighs.

3. Lengthen your spine by pressing your buttocks upwards, while lengthening the crown of your head towards the floor. Tuck in your chin and gaze towards your navel or knees. Draw in your abdominal muscles towards the spine.

4. Once you have reached the maximum extension of your spine, draw your attention to lengthening your legs. Don't lock out the knee joint but work sensitively on opening the back of the knees. Press backwards and downwards with the heels to achieve this. If your heels easily touch the floor, step your feet further away from your hands to create more of a challenge.

5. Ensure your feet are hip width apart and parallel, with toes pointing straight ahead. To get a real sense of extension through the backs of your legs try lifting your toes a little off the floor.

6. Create space between your shoulders and ears by externally rotating your shoulders, *ie* turn your hands so that your fingers now point out to the sides and then spin your hands back to their original position without turning your arms back. Relax your head and neck.

Building up to the pose

This is a challenging posture for beginners, so start by holding for a short duration of 5 to 10 breaths. Come to rest on an exhalation by lowering your knees on to the floor and resting your buttocks back to your heels. If your wrists feel sore after the pose, come to rest in a kneeling position and relieve this tension by circling your hands in both directions.

Gradually build up to holding the pose for a minute, breathing deeply in and out through the nose. Don't be too concerned about how close to the floor your heels can stretch; you'll feel an 'opening' sensation along the backs of the legs regardless of where the heels end up.

If you concentrate too much on stretching the heels down, it's easy to forget to fully elongate the spine, so try to achieve both effects (although it is a compromise). Try closing your eyes to really get connected with the sensations that downward dog creates. Allow your breath to be slow and calm and work as sensitively as you can into the stretch.

Exercise tips

- For greater stability, try elevating your heels against the base of a wall, or take your thumb and forefinger against the base of a wall.
- Beginners and those with really tight hamstrings or restricted mobility about the shoulders should try bending the knees a little or widening your feet stance beyond hip width.
- If you are using the downward dog as part of a warm-up, try 'walking out' the legs, alternating a bend of the knees, or as you inhale, lift on to the balls of the feet and as you exhale, lower the heels back and down towards the floor. Repeat each of these movements several times before coming to stillness.

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The side raise

Muscles involved: Obliques, erector spinae, abdominals, gluteals, latissimus dorsi, quadratus lumborum.
Benefits: Strengthens most of the trunk muscles, making it a very effective exercise as part of a core strength routine.

Functional Anatomy
An increasingly popular exercise, the side raise is actually very demanding and can be considered an 'all-body' exercise as it requires significant levels of co-contraction of most of the trunk muscles.

Research using electromyography (EMG – recording of a muscle's electrical activity) has shown that during this exercise the oblique muscles are working very hard to raise the trunk laterally, while the low back and abdominals are working significantly to assist the obliques. Other research has suggested that this exercise is also an effective way of recruiting the quadratus lumborum muscle, which is an important lumbar spine stabiliser. In addition, the latissimus dorsi muscle helps to stabilise the arm, while the gluteals stabilise the pelvis.

Who should do it
This is a very useful exercise for anyone who needs advanced core strength, specifically in the standing or running posture, *eg* tennis players, rugby players and runners.

Start position
- Lie on your side, legs extended in a straight line, with one arm beneath you and the other extended down your top leg;
- Bend your lower arm and place your forearm on the floor under your shoulder/rib area. Lean on this arm a little, ready to push up;
- Start with your hips 'stacked', *ie* with your top hip directly above the lower one.

Raise movement (see diagram below)
- Push up your hips until your body is raised in a straight line, as shown;
- Make sure your hips remain 'stacked' and don't rotate forwards or backwards, bracing your abdominals and squeezing your gluteals to help you;
- Keep your head in a balanced position, leaning away from your shoulders as if you were standing upright;
- Aim for perfect posture and alignment while you are supporting your bodyweight through your arm;
- Hold this position at the top.

Return movement
- Smoothly and in controlled manner, return to the floor.

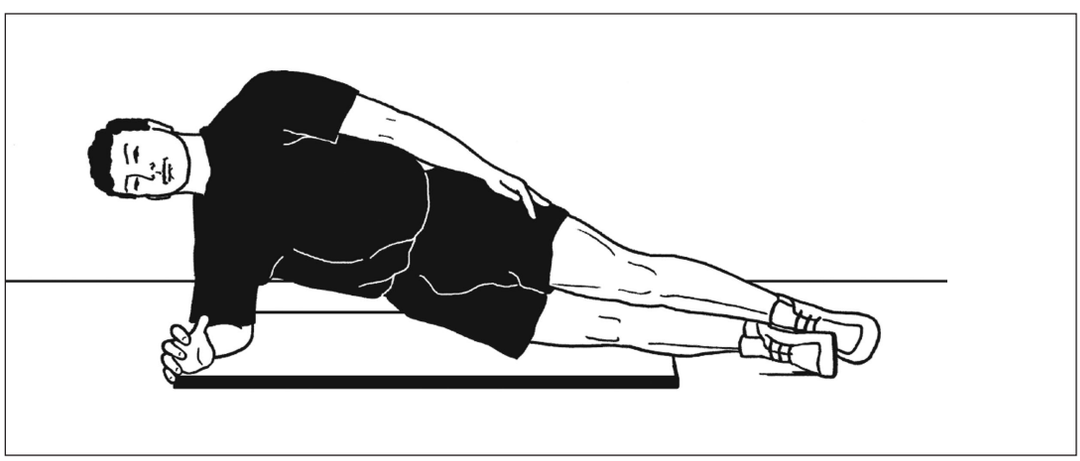
Training tips
Start by holding at the top for 10 seconds and repeat 10 times before changing sides. Build up to sets of 60-second holds, repeating 2-3 times to each side.

Beginner version
Start with your knees bent and your shoulders and knees in a straight line. Push your hips up and form the bridge from your knees to your elbow. Keep a straight body line position as above.

Advanced version
When you lift up your hips, also lift your top leg so that your feet are twelve inches apart. This increases the hip muscle activation.

Raphael Brandon

'An increasingly popular exercise for anyone who needs advanced core strength'



Pre-amble to lower body weights exercises

The legs are the power house of sports performance. Boosting upper and lower leg strength will, for example, lead to enhanced running and cycling speed. However, not only will it do this but it will also boost hitting and punching power as the explosiveness required to land a KO punch, for example, derives from the legs.

Standing machine calf raise

Muscles involved: gastrocnemius, soleus (upper and lower calf muscles)
Joint motion: ankle extension
Sports applicability: all sports, particularly running

Conditioning benefits:

● *General*: This is a great exercise for the lower leg muscles. Because a straight leg position is maintained throughout the exercise, the prime mover is the gastrocnemius, which is best suited to developing force from this stretched position. Note: the seated calf raise emphasises the soleus muscle.

● *Sport specific*: The calf muscles are often neglected in sports conditioning programmes in favour of exercises that focus on the larger thigh muscles – *eg* the squat and leg press. However, a failure to condition the smaller calf muscles appropriately will reduce an athlete's ability to develop optimum propulsive power for running and agility-based sports: the lower leg (and ankle and foot) are crucial in this respect, as the more effective these areas are at cushioning and returning force the quicker and more dynamic the athlete will be. There is also considerable research evidence to suggest that heavy weight machine (or free weight) standing calf raises, which place an emphasis on the lowering (eccentric) part of the movement, are a very effective way of conditioning out potential Achilles tendon problems and even treating Achilles tendinosis (see *PP 206 Dec 04* and *The World Sports Science Training Workbook, PP* books 2004).

Alfredson *et al* discovered that heavy weight eccentric calf lowering exercises were a great treatment for long-term Achilles tendinosis in research on recreational athletes

Start position

● Stand tall under the machine's pads and take hold of the grips with your elbows flexed. Your feet should be facing forwards, not splayed or turned inwards;

● Look straight ahead and keep your back in neutral alignment – *ie* not arched or rounded;

● Keep your ankles, knees and hips in alignment, making sure your ankles are lined up with each other on the footplate, with your weight supported by all your toes;

● The standing calf raise machine allows the exercise to be performed with the heels below the toes – a position that works the calf muscles over a greater range of movement (ROM). However, you should not force this position – *ie* attempt to achieve a lowered heel position that is beyond your normal ROM – as this could injure your calf muscles and/or Achilles tendons.

Action

● Contract your calf muscles to lift your body;

● Lift to full ankle extension, pause and lower under control. Because of the exercise's remedial/injury prevention capability, you should lower to a count of three and raise to a count of one.

Training tips

Look straight ahead and focus your balance so that it is evenly distributed across your toes. This will avoid rolling the ankles over or inwards, which could lead to injury.

Start with 4 x 10 reps, at 70% of 1 repetition maximum (1RM) to a 'one-up, three down' count. Take 90 seconds' recovery between sets.

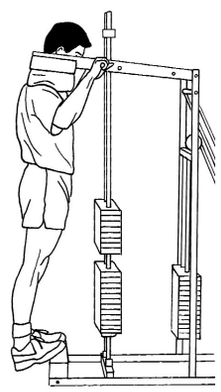
Variations and sport specific progression

Single-leg body weight calf raise: Calf raise exercises are more sport specific when performed from a free-standing position, with or without weights. These exercises develop proprioceptive ability and recruit numerous, much smaller, stabilising muscles that are often not significantly challenged by fixed weight machines. To perform the exercise, stand on one leg with the other tucked up towards your buttocks. Position your arms out to the sides to aid balance. Extend up onto your toes and lower slowly. Perform 3 x 10 single-leg calf raises on each leg, with 90 seconds' recovery between sets. Once you can handle these comfortably, add to their difficulty by holding light dumbbells (10kg) in each hand.

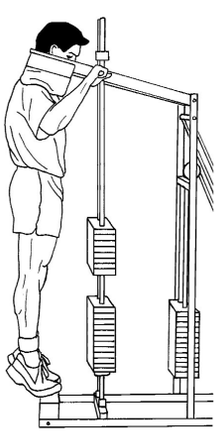
Straight leg jumps: This progression develops real dynamic power in the lower legs. From a standing position, use feet, ankles and calf muscles to propel your body into the air. Bend your knees very slightly to start the exercise and to absorb the impact of each landing. Think 'light and fast'. Perform 3 x 10 reps with 90 seconds' recovery.

John Shepherd

Start position

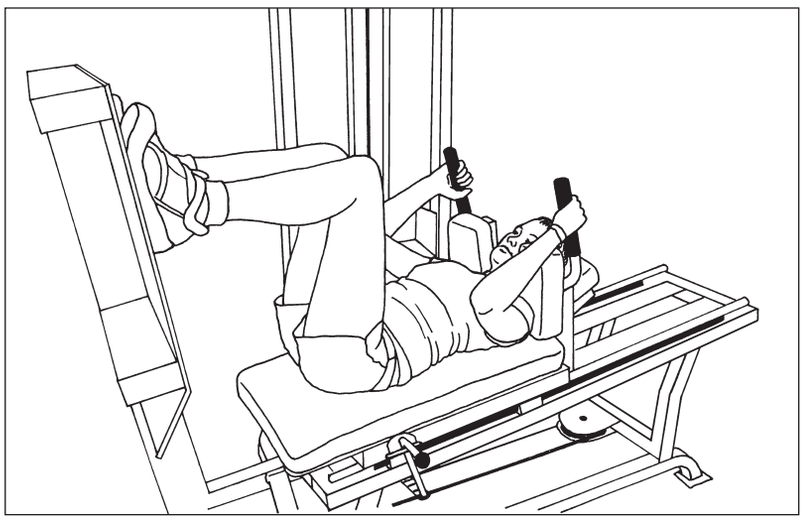


Action



Machine leg press

Muscles involved: gluteus, hamstrings, quadriceps.
Joint motion: hip extension, knee extension.
Sports applicability: all sports, particularly rowing.



Conditioning benefits

● *General.* The leg press is a great multiple joint exercise for those looking for increased lower body strength. As no weight is supported through the back, the exercise is suitable for those who have not developed sufficient core strength to handle heavy squats and/or have lower back problems that could make squatting problematic;
● *Sport specific.* The exercise provides a great foundation of leg strength for virtually all sports. It can directly assist double-footed jumping power (especially when performed explosively – *ie* to a 'one' count on the press and a 'two' count on the lowering phase). Specifically, its action is akin to the leg drive in rowing, which obviously makes it very useful for exponents of this particular sport.

Start position (above right)

● First select the weight to be pressed by placing the selector pin in the weights stack;
● Adjust your body so that you achieve a 90° (or slightly greater) angle at your knees. Your feet should be positioned on the machine's plate slightly wider than hip width apart, with your toes pointing straight up, or slightly turned out;
● Hold the machine's grips;
● Maintain the natural curve in your back (neutral spine position).

Action (below right)

● Push against the plate until your legs are virtually straight;
● Pause and flex your knees and hips to return to the start position – making sure you do this in a controlled fashion;
● To minimise knee injury, ensure *that the push and return movement* is completed in a perfectly straight line – there should be no lateral movement around the knees. Do not lock your knees out. Also make sure that your knees do not move beyond your toes, when pressing and returning the weights.

Training tips

Controlling the return movement will boost the contribution the hamstrings and glutes make to the move, by maintaining greater muscular tension.
● *For explosive power* perform 4 x 6 reps at 80% of one-repetition maximum (1RM), to a one up, two down count;
● *For strength endurance* perform 4 x 20 reps at 55% of 1 RM to a one up, one down count.

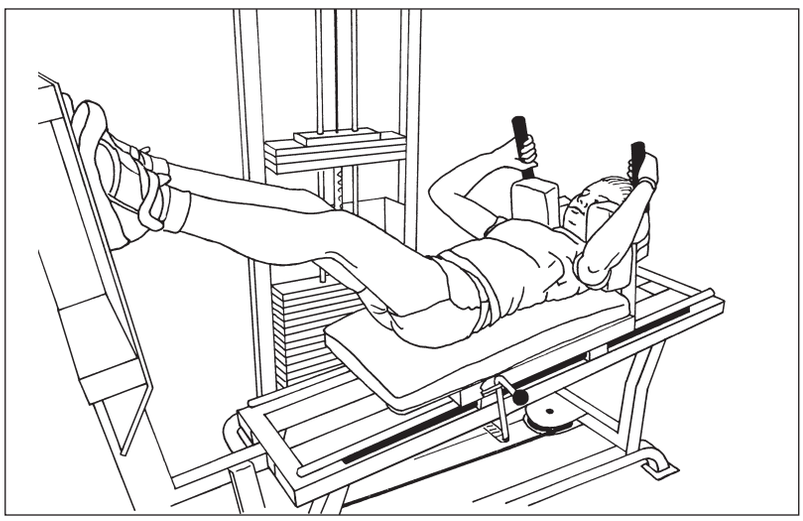
Variations

Single leg press. Single leg press: Assume the same starting position as above, but this time use only one leg. The unilateral movement will make the exercise more relevant to the running action and allow you to address muscular strength imbalances between left and the right legs. Ideally, a 1RM should be established for both legs. If there is a great disparity in strength between the two legs (more than 10%) it is worth emphasising strength development in the weaker limb. This can be achieved in various ways – *eg* by performing two sets on the weaker side and only one on the stronger during workouts. Balancing leg strength will increase general and specific sports power potential and reduce the risk of injury.

Note: There are considerable variations in leg press machine design. As well as the one described above there are machines that allow for the plate to be pushed away from you and then controlled on return to the start position. There are also devices designed to be used with free weights. Whatever machine you use, make sure that your back remains in a neutral position. Some machines may 'force' your back flat – particularly when lifting a heavy weight. If this happens it is best to truncate the exercise.

'A great foundation of leg strength for virtually all sports, particularly rowing'

John Shepherd



The front squat

Major muscle groups involved: quadriceps (thigh) and gluteus maximus (buttocks).

Benefits: a great exercise for the major knee and hip extensor muscles. With good technique, athletes can gain strength in the quads and glutes. The movement relies on good flexibility and posture, so learning to perform it well will improve you in these respects. The lower back, in particular, will develop stability as a result of front squat practice. The front squat is also part of the 'Clean' movement, an Olympic lift exercise, and learning it will certainly improve your Clean technique.

Who should do it? I would recommend the front squat most for athletes in running-based sports because the quadriceps muscles are being trained in conjunction with the hip muscles, echoing the way they are used in running and jumping.

Start position (below left)

Stand in front of the bar, feet hip-to-shoulder-width apart, and take it from the rack or bar stands with a shoulder-width grip. Place palms under the bar and push your elbows up and forwards, so that it rests on the top of your chest and across your shoulders. It is very important to push the bar upwards so it rests on your body, otherwise you have to hold the bar in place, which is very difficult with heavy weights. Stand upright with the bar resting solidly on your shoulders. Fix your eyes forwards and lift up your sternum, so you feel your shoulder blades pinched slightly in your upper back. Your posture and bar will be secure in this position.

Downwards movement (below right)

With your eyes facing forwards, slowly squat down, bending from the hip and the knee, keeping your back straight and your chest up to ensure good posture. As you go down, you will feel your weight move into the back of your foot as if you are about to sit on a low stool. The extent of your squat will depend on your strength and flexibility, but the aim is to get your knees to bend to an angle of 90°. In this bottom position your heels must be on the floor, your back straight (chest out) and your knees in line with your feet. If your back flexes, your knees go in or out, or your heels come off the floor, you should limit the range of movement in order to maintain correct technique.

Upwards movement

Push down into the floor through your heels, keeping your knees aligned with your feet, and drive your hips up and forwards. This powerful movement uses the gluteus maximus and quadriceps most effectively, and as you do it you should feel strong. Return to the start position with your eyes forwards and your posture erect.

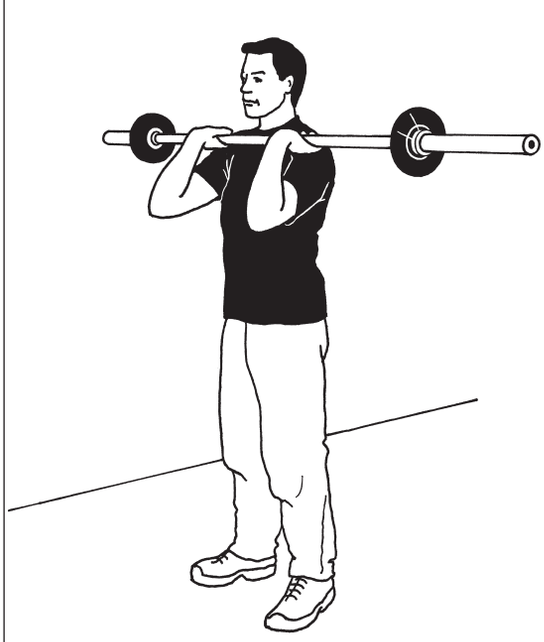
Technical tips

Some athletes struggle with wrist and shoulder mobility to position the bar correctly across the top of the shoulders. Stretching these areas before the lift will help you achieve the correct position.

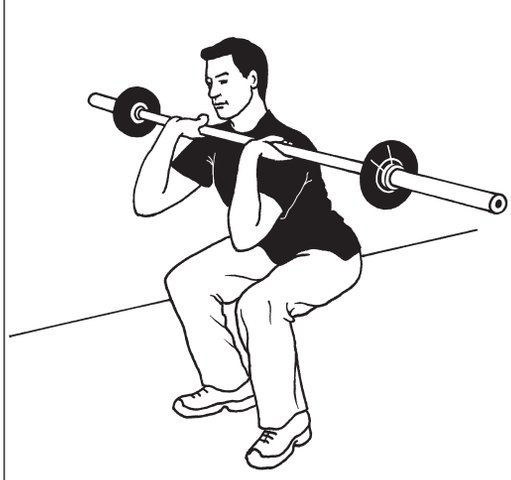
Raphael Brandon

'The front squat – a great exercise for the major knee and hip extensor muscles'

Start position



Downwards movement



The split squat

Muscles involved: quadriceps (thighs), hamstrings, glutes (buttocks)

Joint motion: hip extension, knee extension

Sports applicability: all sports, with particular relevance to running

Conditioning benefits

- *General*. The split squat is basically a single-leg squat. It can be performed by athletes with varying degrees of strength, although it becomes a more advanced exercise when heavy weights are used and should be performed only by the well-conditioned.
- *Sport specific*. The exercise is particularly beneficial for those in search of greater sport specific leg strength and power. This is because it works only one leg at a time and requires a degree of balance to perform – both key aspects of sports performance.

Start position

- Support the weight across the top of your shoulders on the fleshy part, using a padded bar or towel for cushioning. Use an over-grasp grip and space your hands wide enough for stability;
- Keep your back in neutral alignment, *ie* not arched or rounded;
- Maintain the weight centrally across your shoulders, *ie* at the top of an imaginary line drawn through the middle of your shoulders and hips;
- Focus on maintaining the loading of the exercise on your front leg.

Action (above right)

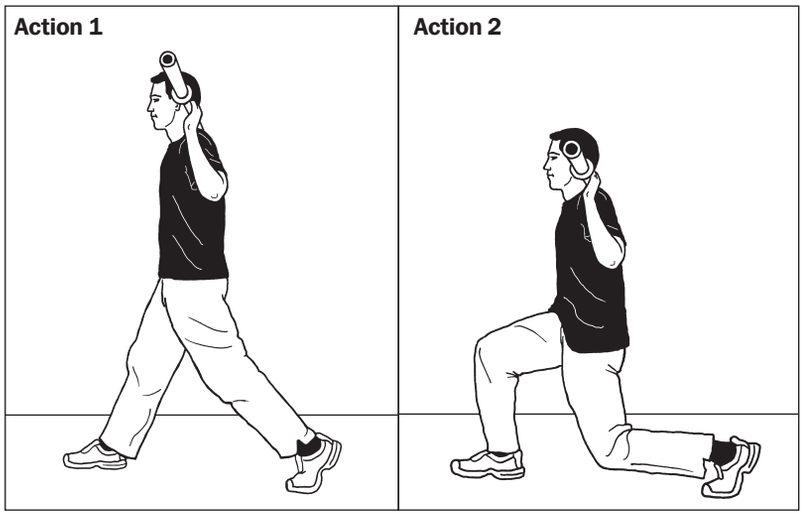
- Take a big step forward with one leg, placing foot flat on floor, supporting weight on toes of rear foot, rear knee slightly bent (*action 1*);
- Bend your knees and hips, dropping your buttocks towards the ground to lower the weight (*action 2*);
- Keep going until you reach a 60-90° angle of knee flexion with the front leg;
- Extend the knee and hip of your front leg to push yourself back up to the start position.

Training tips

Maintain neutral posture and a balanced elevated chest position throughout the exercise. When lowering the weight, ensure that the knee of your front leg remains behind its ankle and does not wobble either side of it, as this could place strain on the ankle joint.

If using a heavy weight, perform the exercise from under a squat rack.

Start with 4 x 10 reps on each leg, at 50% of 1 repetition maximum (1RM) to a 'one-up, one-down' count. Take 90 seconds' recovery between each set.



Sport specific exercise progression

Split squat jump: This variation adds real dynamic power to the exercise and enhances its relevance to similarly dynamic sports. Assume the same starting position described above, but this time, after lowering your body, drive up powerfully with your front leg to lift your body into the air. While airborne, swap the position of your legs, land in the split squat position then immediately leap into another jump (without undue yielding of the front thigh). Continue in this fashion until you have completed 4 x 10 jumps, with 90 seconds' recovery between sets.

Always land 'light' on your feet, towards the forefoot area and on the toes of your rear leg. Use your arms to add momentum to the jump by swinging them first back and then through and in front of your hips as you strike the ground. At the highest point of the jump your arms should be held straight up on either side of your head. As with the static weight training variant, keep your chest elevated throughout the exercise.

You will require a good level of base power to perform this jump with a wide stance landing. If you are new to this exercise, you can reduce the strength requirement (and increase the speed component) by landing and jumping from a narrower stance. Note that the narrow landing split squat jump is an exercise in its own right and should not be seen as one for beginners. Try combining both variants into your workouts.

Weights can be added to these dynamic exercise variants, although supporting a barbell across your shoulders is best avoided because of the strain it can place on your lower back and knees. Holding dumbbells at arms' length by your sides is a safer alternative, but you should be careful to hold these relatively still to maintain the integrity of the exercise. Some arm movement is inevitable, but as long as this is minimal it could actually prove beneficial by increasing the spatial awareness and balance requirements of the exercise.

John Shepherd

Pre-amble to upper body weights exercises

A stronger and more dynamic upper body will reduce injury potential (particularly to the core) and will also maximise the ultimate release of power through the arms - a requirement, for example, of the javelin throw.

The single arm row

Muscles involved: Latissimus dorsi, rear deltoid, rhomboids, mid-trapezius, biceps.

Benefits: In the recent Injury Special (*PP184, July 2003*), Ulrik Larsen described how to prevent shoulder injuries with practical exercises and self-massage techniques. A key piece of advice was to always ensure that the rear shoulder and upper back musculature is as well developed as the front shoulder muscles. I would recommend the single arm row exercise as one of the most effective means of achieving this end.

Who should do it? The single arm row is the natural opposite movement to the bench press exercise. By incorporating both exercises into your training programme, you will develop upper body strength in a balanced way. This makes the single arm row a great exercise for athletes in any sport requiring upper body strength. Specifically, it is very useful for runners and sprinters in developing the muscles involved in a powerful arm action, since it involves pulling the elbow straight back behind the body.

'A great exercise for athletes in any sport requiring upper body strength'

Start position (below)

- Form a stable base by placing your right hand firmly on the bench in line with your shoulder, with your right knee on the bench and the other foot on the floor, parallel to the resting knee. The idea is to form a solid right-angled triangle between the foot, knee and hand. Make sure your back is straight, with your lumbar spine in the neutral position. Sticking your chest out can help achieve this position;
- Pick up the dumbbell (DB) off the floor with your left hand, holding it directly under your shoulder.

Pull movement (below)

- Initiate the lift with your elbow, by pulling it directly upwards. Imagine a string is attached to your elbow, pulling your arm up;
- Avoid any shoulder or trunk rotation as you pull the DB, so that only your arm moves, while your shoulders remain level;
- Finish with the DB up by your body as close as possible to your armpit;
- Avoid arching or rounding your back to initiate or finish the lift;
- Breathe out at the top of the lift.

Return movement

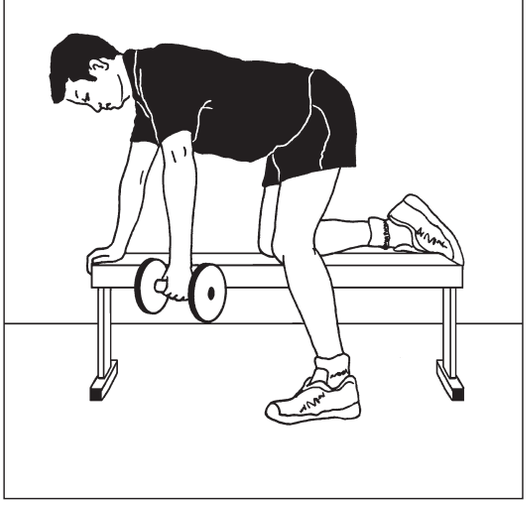
- Breathe in smoothly as you slowly lower the DB down to the start position, using your shoulder and arm muscles to ensure a gradual descent;
- Ensure your back is straight, your shoulders are wide and your posture is good before initiating the next pull.

Training tips

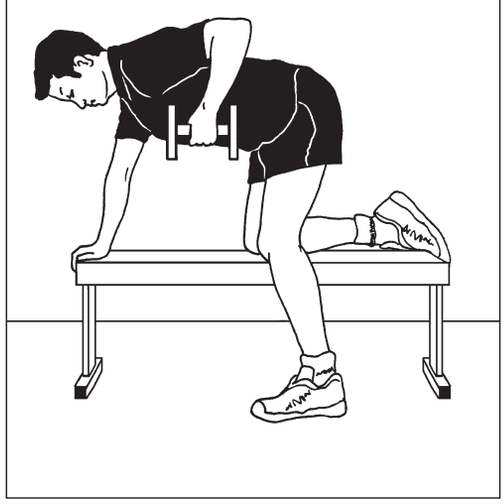
To develop muscle mass or strength endurance, perform 3-5 sets of 10-15 reps, with 60 seconds' rest between sets. To develop maximum strength, perform 3-5 sets of 3-5 reps, with 2-3 minutes between sets.

Raphael Brandon

Start position



Pull movement



The straight arm pullover

Muscles involved: Pectoralis major and minor, latissimus dorsi, deltoid, rotator cuff group, subscapularis.

Benefits: The pullover exercise is very good for improving the strength of most of the muscles in the upper body through a full range of motion, thus also boosting the mobility and strength of the shoulder muscle. It is an excellent complement to the more popular bench press and lat pull down exercises. A dumbbell (DB) is specified for use with this exercise, although it can also be done with a barbell.

Who should do it: I have found this exercise particularly useful for runners with tight shoulders and rounded upper backs. It is also specific to any overhead movement, such as javelin throw, tennis serve, badminton shot, rugby hooker's throw-in and football throw-in.

Start position (below)

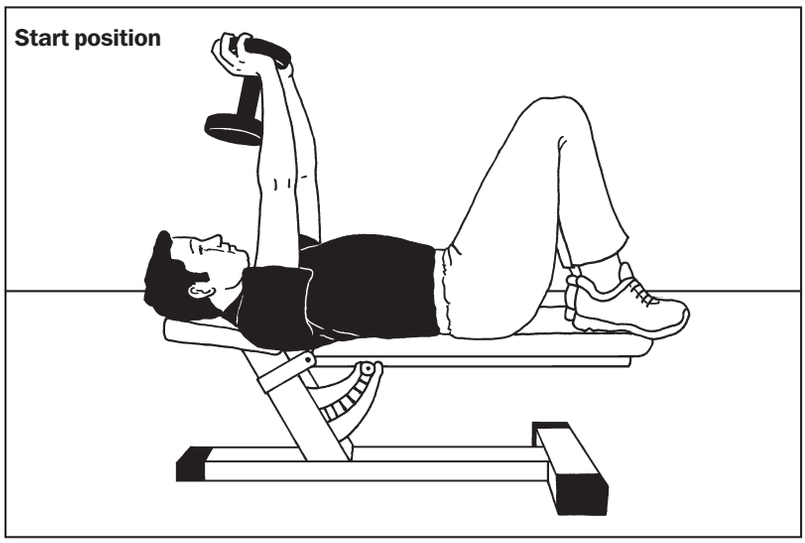
- Grasp the DB close to your body and lie down carefully on your back on a bench;
- Bend your knees so that your back is comfortable and in a 'neutral' position – neither arched nor flat;
- Hold the DB as shown, with one fist next to the other;
- Straighten your arms and raise the DB directly above your chest.

Lowering movement (above)

- Slowly take the DB back over your head, breathing in and keeping arms straight;
- If your back starts to arch as the arms go back, use your abdominal muscles to maintain the neutral lumbar spine position. (This exercise can boost your core stability as well as your arm strength);
- If your back starts to arch a lot or you feel the stretch in the shoulders, stop. Be careful not to stretch your shoulders too far with a large weight, as you could strain them;
- Taken to the correct range of stretch, the weight will improve flexibility in your upper spine and shoulders. You will feel your chest pointing up and your upper back arching a little, while your lower back remains in neutral.

Pull movement

- Keeping elbows straight, pull the DB back over your head to the start position;

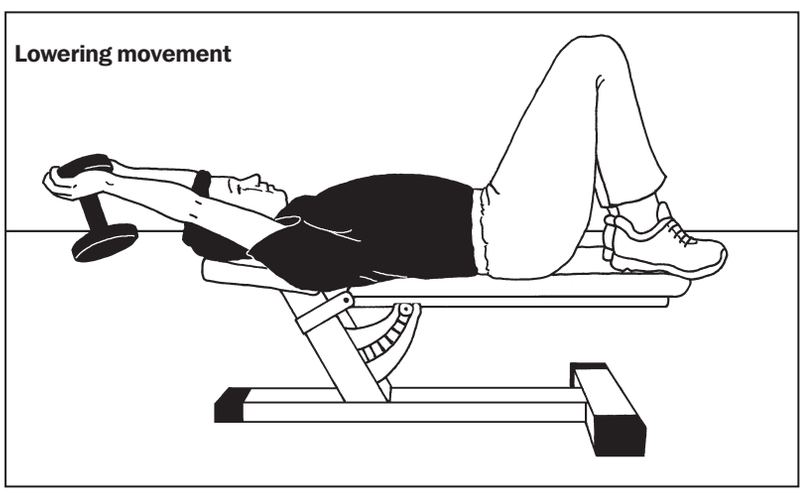


- Focus on keeping shoulders wide as you pull, and avoid hunching up;
- Breathe out once the DB has returned to the top;
- As before, use your abs to control your back position throughout the pull movement. Only your arms should move during this exercise.

Training tips

Perform 2-4 sets of 10-15 repetitions for strength endurance and muscle hypertrophy. Build up slowly before attempting heavier weights for maximum strength because of the large range of motion of the shoulder used during the movement.

Raphael Brandon



Supine dumbbell straight arm pullover

Muscles involved: sides of upper back (latissimus dorsi), backs of shoulders (posterior deltoids), backs of upper arms (triceps)
Joint motion: shoulder extension
Sports applicability: sports involving an overhead hitting/throwing motion, *eg* tennis, the javelin and football throw-in

Conditioning benefits

1 *General*. The supine straight arm dumbbell pullover can be performed by people with varying degrees of strength, although it becomes more of an advanced exercise when heavy weights or a dynamic throwing type action are used. In these conditions, it should be performed only by the well-conditioned.

2 *Sport specific*. The exercise has a great preconditioning (training to train) value, as it can strengthen soft tissue for much more dynamic sports related activity, thus reducing injury risk.

Start position (above right)

- Lie on your back on a bench and place your feet on the floor or, depending on your leg length, a step or similar platform. In achieving this position make sure that your back remains in neutral alignment on the bench (*ie* neither arched nor rounded) and that your position is stable;
- Hold a fixed-weight non-adjustable dumbbell over your chest with both hands, using a 'triangular' grip. Keep your palms up and your fingers pointing away from your head;
- Maintaining a slight bend at your elbows, rotate your shoulders slightly inwards.

Action (below right)

- Take the dumbbell back and behind your head by lowering your arms. Don't allow your elbows to move outside the line of your body;
- Change from lowering to lifting the dumbbell when your upper arms are approximately 20-30° higher than parallel to the floor.

Training tips

Avoid hyperextending your wrists, keeping them in a neutral position while performing the exercise.

Keep your abdominal muscles braced when lowering the dumbbell behind your head to avoid hyperextending your back.

Start with 4 x 15 repetitions at 50% of 1 repetition maximum (1RM) to a 'one-up, one-down' count. Take 90 seconds' recovery between each set.

Sport specific exercise progressions

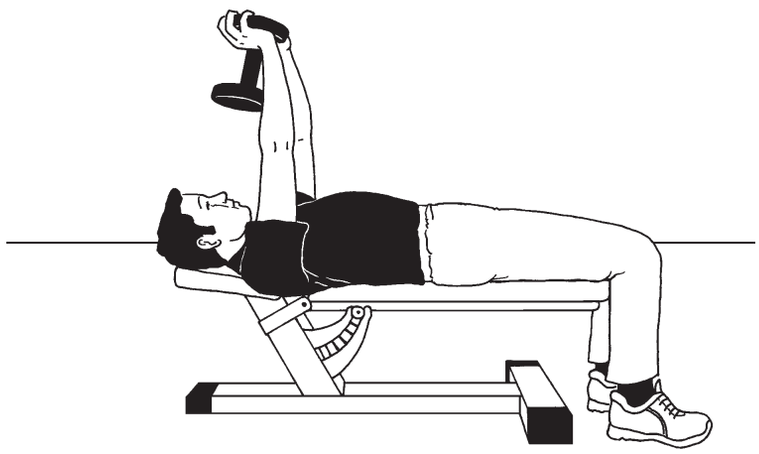
Supine bent arm pullover. After assuming the same start position as above, perform the exercise with bent arms – *ie* with the lower arms held at right angles to the upper arms; this places a different emphasis on the muscles being worked. Perform as above, or by alternating the two versions into a super-set;

Fit-ball supine bent arm pullover. Assume a similar starting position, with the upper back supported on the Fit-ball and the feet firmly planted on the floor. While performing either the straight or bent arm pullover, the inherent instability of the ball will call for greater active stabilisation throughout the core. This will be beneficial in two ways:

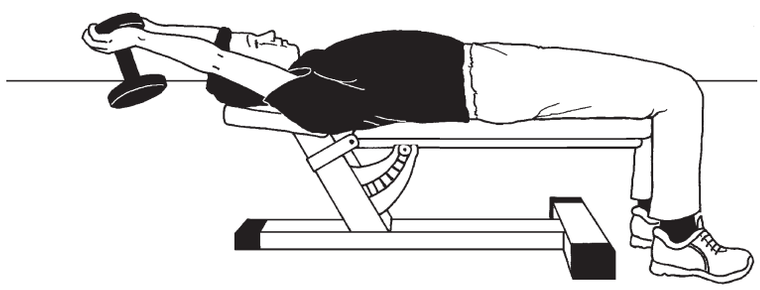
- More muscle fibre will be recruited from this region;
- The exercise will be more sport specific because the core works to transfer and optimise the power expressed by the arms, as it does in most sports situations.

Fit-ball supine medicine ball throw. In terms of progression, this exercise is right at the top of the conditioning chain for those involved in dynamic throwing and hitting sports. From the same start position, hold a light medicine ball in two hands at arms' length over your chest. Take your arms back (either straight or bent, as per the dumbbell variants) then bring them forwards dynamically to throw the ball to a partner or against a wall. Power should be generated through the core before being released through the arms. Perform 4 x 10 repetitions, with recovery as above.

Start position



Action



John Shepherd

Standing stiff arm pull-down

This exercise is not in the standard repertoire but is nevertheless highly beneficial. It is a simple movement, but correct performance requires good coordination and core strength.

Muscles involved: Latissimus dorsi and rear deltoid (prime movers); abdominals, obliques, gluteals, lower trapezius, erector spinae (stabilisers).

Functional anatomy: The stiff arm pull-down movement is simply shoulder extension, for which the large latissimus dorsi muscle in the upper back is the prime mover, assisted by the rear deltoid fibres. If you are using a cable machine that is tall enough, it is possible to train the shoulder extension movement through a large range of motion, from nearly fully flexed to nearly fully extended (as shown). This makes the movement functional for both the swimming pull and all throwing movements (including tennis and cricket).

Performing the movement in a standing position requires the trunk muscles to stabilise the spine; otherwise the back will flex forwards as the shoulder extends. To keep the lumbar spine in a neutral position throughout the movement, the abdominal, oblique and gluteal muscles need to be active. To ensure the spine remains tall and upright, the erector spinae must also be active, while the lower trapezius will be active during the pull-down movement to ensure the scapula is controlled correctly.

Benefits: Upper body strength – specifically the pulling movement – and advanced core stability of the lumbar spine.

Who should do it: Swimmers, javelin throwers, cricket bowlers, tennis players and back rehab patients (the latter using light weights only).

Start position (below left)

- Stand up tall in front of the cable machine;
- Place one foot slightly in front of the other to aid stability;
- Adjust your lumbar spine to the neutral position;
- Tuck in your abs and squeeze your gluteals to 'lock' neutral lumbar spine;
- Place your hands, about shoulder width apart, on the straight bar above your head, using an overhand grip;
- Keep your posture good (abs in, chest out, shoulders wide);
- Keep your elbows straight as you grip the bar.

Pull-down movement (below right)

- Pull on the cable, bringing your hands down to your front;
- Keep your elbows straight throughout the movement (that's why it's called 'stiff arm pull-down');
- Your hands will move in an arc, finishing close to your hips;
- Throughout the movement, use your trunk muscles to retain perfect posture;
- Use your lower traps and pull your shoulder blades down into your spine as you pull the arms down. This increases the effectiveness of the movement.

Return movement

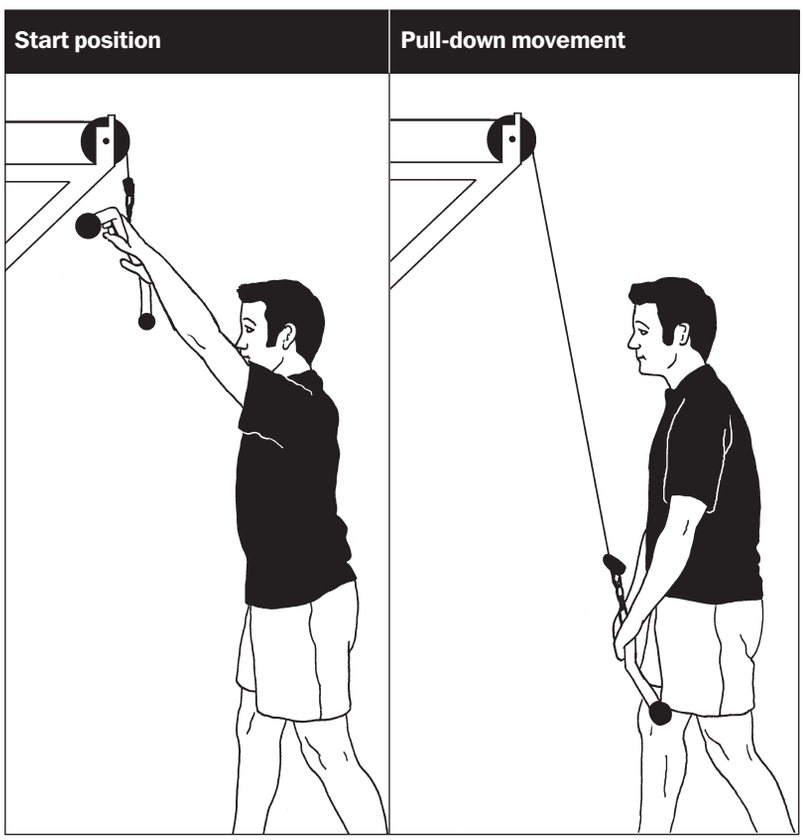
- Slowly, allow the bar to rise back to the start position;
- Keep control of the bar using your shoulder muscles – do not let it fly back up;
- Retain perfect posture and neutral lumbar spine throughout.

Training tips

Start with light weights in order to master the movement. Avoid weights so heavy that you have to use a back movement to complete the pull-down. For sports performance, sets of 6-10 repetitions with moderately heavy weights will be suitable. Back rehab patients should focus on sets of 20-30 reps with light weights to ensure spine forces are low and the exercise predominantly develops good postural control rather than upper body power.

'Avoid weights so heavy that you have to use a back movement to complete the pull-down'

Raphael Brandon



Pre-amble to dynamic/power exercises

These more specialist exercises are the holy grail of improved sports conditioning. They are the ones that add that 'something extra' to achieving peak sports ability. They will stimulate both muscles and mind to produce maximum 'body horse power'

Hand-to-knee reaction/'wake-up' drill

Muscles involved: hip flexors (NB this exercise and its variations are less about the training of particular muscle groups and more about firing up the nervous system)
Joint motion: hip extension
Sports applicability: all, but especially speed, power and combat sports, such as boxing and martial arts

Conditioning benefits

- *General:* It is not worth really focusing on the mechanics of the exercise in terms of strength development (this is only minimal), as this exercise is really all about firing up the nervous system and waking up muscle and the brain for dynamic and challenging sporting activity. Having said that, the exercise is closely related to the sprint running action, specifically the 'hip pull-through phase'. This occurs after the leg drive, when the leg folds up beneath the sprinter's body and the heel travels up toward the buttock, before being pulled through from the hips dynamically into the next stride.
- *Sport specific:* The hand-to-knee reaction drill was brought to my attention over 20 years ago, when training with head Soviet track coach and former world long jump record holder Igor Ter-Ovanesyan, and is one of a number of drills that are designed to 'light up' an athlete's neuromuscular system.

The drill is designed to get you into the 'right frame of mind' before dynamic sporting activity. For example, if you're about to run a 100m sprint, you don't want your brain to be woolly and lacking focus. Rather, you need to explode out of the blocks, moving your limbs as fast as is possible (with relaxation of course).

The hand-to-knee drill should form a part of warm-up and can be performed literally in the seconds before making an explosive effort. Its aim is to prime you optimally for this type of activity.

Start position (above left)

Assume a medium stance lunge position. Keep your trunk upright and look straight ahead. Extend the arm on the other side of your body to the front leg and hold the hand parallel to the ground, with the palm facing downward.

Action (above right)

- Summoning your mental energy and focusing on your hip, 'drive' the knee toward your hand as fast as you can, by driving your hip forward and up. Do *not* move your hand toward your advancing knee, to shorten the movement;
- Return the foot to the floor and either pause for a second before repeating or immediately perform the exercise again.

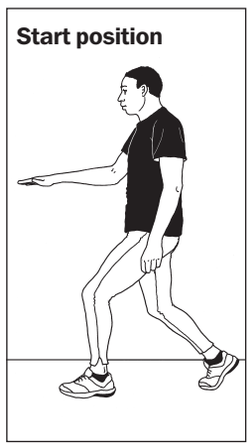
Training tips

Maintain neutral posture and a balanced elevated chest position throughout the exercise. Concentrate and focus all your energy into the movement. Start with 3 x 6 repetitions.

Variations

- *Jog and rapid foot strike drill:* This drill is used by sprinters to heighten their neuromuscular capacity, but can be used by those from other sports. Begin jogging and after 5-10m 'dab' your feet as fast as possible in an alternate action against the ground. Complete 6-10 dabs. The dabbing movement is achieved by lifting one foot at a time just a couple of centimetres from the ground and dynamically pushing back down, as fast as possible in a very staccato movement. Each dab should be about a foot's length in front of the other. Foot-strike is made on the forefeet/balls of the feet.
- Perform one set of dabs, jog for 5-10m and then perform another. Coordinate your arms with your legs, moving them as fast as is possible to encourage speed. A slight forward lean during the dabbing phase is permissible, with the knees pushed forward and head inclined toward the ground. However, particularly for sprint athletes, an attempt should be made to perform the drill from a more upright stance, as this better reflects the posture of the sprint action. This drill is best performed on an athletics track, or similar true and giving surface. Try four repetitions.

John Shepherd



The depth jump

Main muscles involved: quadriceps (thigh), hamstrings, glutes (buttocks), calf muscles
Joint motion: ankle extension, knee extension, hip extension
Sports applicability: running (sprinting, middle and long distances), all running and jumping based sports such as tennis, football, basketball and high jump etc

Muscular action

The depth jump is a plyometric exercise. Plyometric exercises work on the principle that a concentric muscular contraction is much stronger if it immediately follows an eccentric contraction of the same muscle. (Eccentric muscular action occurs when a muscle lengthens under load – *eg* the lowering phase of a biceps curl. Concentric muscular contraction occurs when a muscle shortens under load.)

The effect of a plyometric exercise is a bit like stretching out a coiled spring to its fullest extent (the eccentric contraction), then letting it go (the concentric contraction); large amounts of energy are released in a split second as the spring recoils.

Conditioning benefits

- **General** – The depth jump provides a great base of dynamic power for the majority of sports. This is because it closely matches the sport specific speeds of movement and muscular action. Most standard weight training lifts, even when performed as quickly as possible, take 0.5-0.7 seconds to complete, whereas during a depth jump your feet may only be in contact with the ground for between 0.2 and 0.3 seconds.
- **Sport specific** – Although the basic depth jump is very sports specific in itself, it can be made even more so by adaptation and variation (more later).

Start position

Stand on top of a strong platform 0.5-0.8m high (the greater the height, the greater the strength component, the lower the height the greater the speed component).

Action

1. Step slightly forward off the platform. Land toward your forefeet;
2. React as quickly as possible to the ground and spring immediately back up into the air;
3. Use your arms to add to your speed by drawing them back prior to stepping off the platform and swinging them vigorously upward as your feet hit the ground;
4. Keep your back in neutral alignment, *ie* not arched or rounded;
5. Focus your gaze straight ahead of you.

Training tips

- Maintain neutral posture and a balanced elevated chest position throughout the exercise. Do not attempt to absorb the landing on impact, rather react as quickly and as fast as you can, even if this sacrifices height gained;
- The faster a muscle is forced to perform an eccentric contraction, the greater the concentric force it can generate. To help your understanding: think of a rubber ball being thrown against a wall. What happens when the ball is thrown harder? It springs back even faster and further. This is the effect you are looking for when performing plyometric exercises, like the depth jump;
- Always warm up thoroughly before performing depth jumps;
- Don't perform more than two workouts a week and allow at least five days before important competitions;
- Monitor the number of jumps performed. Depth jump volume is measured in ground contacts; avoid more than 60 in a session. Start with 3 x 6 repetitions;
- To allow your power-producing fast-twitch muscle fibres to be at their most effective, take 30 seconds recovery between exercises and two minutes between sets;
- Perform depth jumps on a non-slip flat surface – a sprung gymnasium floor or an all-weather athletics track are ideal surfaces;
- You need to be in 'the right frame of mind' to get the most out of depth jumping. Going through the motions will not turn on sufficient neuromuscular input to optimise their performance.

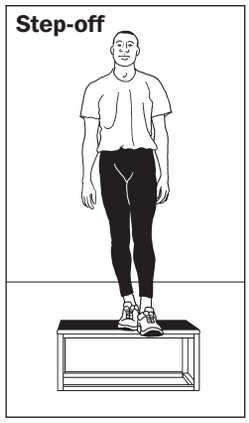
Sport specific exercise progression

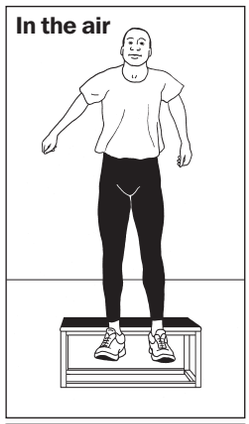
Single-leg depth jump (hop) for distance

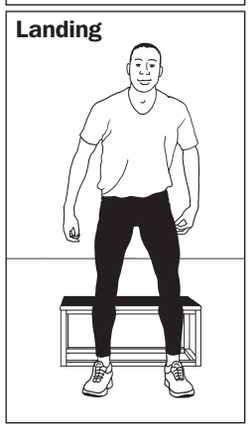
This variation will up your leg muscles' power and is a great exercise for field and racket sports players, sprinters and jumpers (where all movements are performed with an independent leg action). Note the single-leg depth jump places greater potential strain on the legs and back, as such this exercise should only be performed by those with a high degree of prior plyometric training experience.

Assume the same starting position as for the first exercise, but this time drive forward to land about 1m in front of the platform, on the same leg. React as quickly as possible to the ground and hop forward as far as you can. Maintain an upright posture and cycle your hopping leg under your body whilst in the air. Coordinate your arms with your legs, *ie* in a running, 'opposite arm to leg' style. Try 3 x 5 repetitions, alternating left and right leg sets.

John Shepherd







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