NASM
NATIONAL ACADEMY OF SPORTS MEDICINE

THE NASM GUIDE TO

SQUATS AND DEADLIFTS: MASTER THE FUNDAMENTALS

Contents

Welcome!

Welcome, and thank you for choosing to delve into this comprehensive guide that discovers the intricate world of two fundamental exercises – the squat and the deadlift.

The information here is comprehensive, considering the most recent scientific literature, ensuring you'll benefit from the most accurate, up-to-date insights available.

Whether you're a fitness enthusiast seeking to maximize your workout routine, a personal trainer striving to provide your clients with the best training programs, or a coach looking to improve your athletes' performance, this guide is tailored to suit your needs. It will give you the tools and understanding necessary to make informed decisions regarding these fundamental movements, allowing you to extract maximum value from squats and deadlifts.

Thank you once again for your time and interest!

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Sports Performance Coach, Author, and International Speaker
Educating Through Scientific Strength When Science Meets Muscle

About NASM

At the National Academy of Sports Medicine (NASM), our mission is to provide world-class fitness and wellness information and tools to transform lives. We help personal trainers, coaches, their clients, and anyone with a passion for fitness live healthier and happier lives.

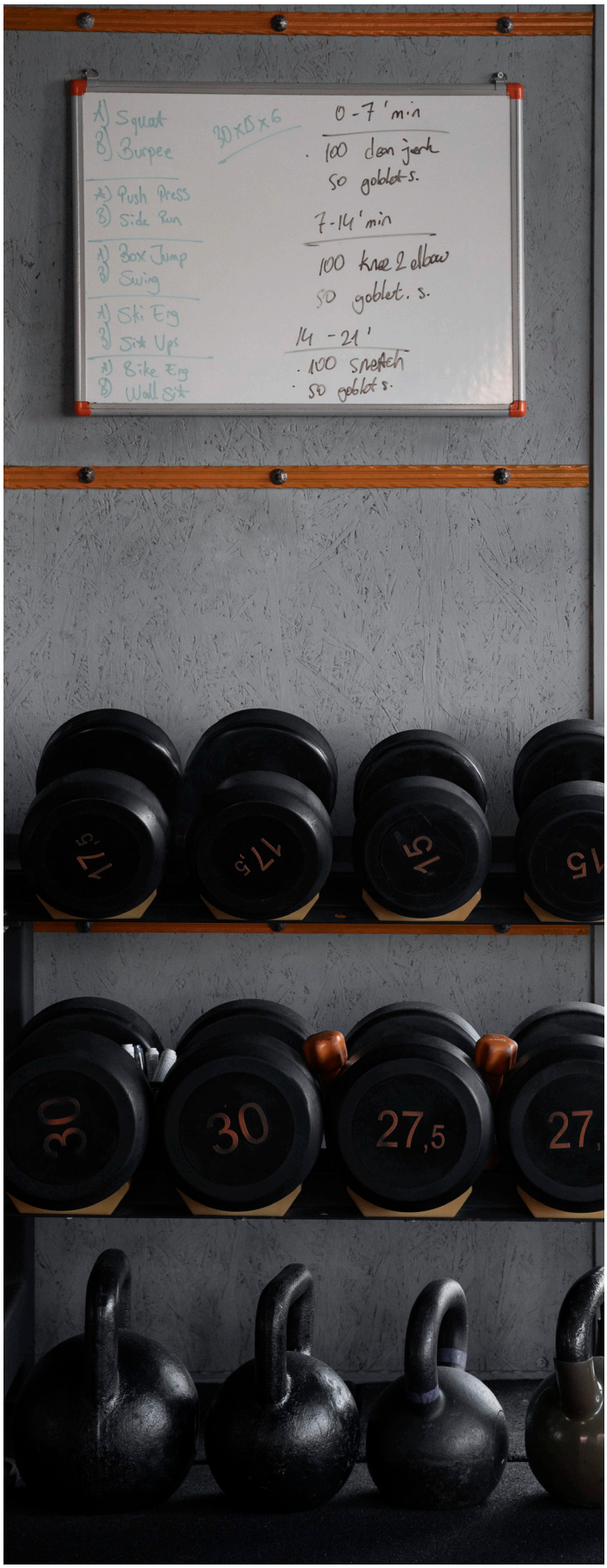
With over three decades of experience providing the best certifications in the fitness industry, we have earned an impeccable reputation for science-based strategies and learning innovations. To learn more, please visit www.nasm.org.

Getting the Most from This Guide

This guide aims to provide the knowledge and actionable steps to help you maximize the immediate utility and application of squat and deadlift exercises.

This guide will walk you through information explaining a little bit of the "why" behind the "how." With the knowledge and actionable steps provided in this guide, you will be well-equipped to maximize the benefits of these essential exercises.

Please feel free to return and use the information as a reference anytime. Be sure to use the key takeaways and application strategies in whatever way makes sense for you. You are not obligated to put *everything* into action right away. When you're ready to dive deeper into the topic, please check out our recommended resources.



Introduction

Regarding exercise, the squat and deadlift are some of the most popular movements you will see at the gym. They are an ideal choice for most populations and can be catered to help achieve just about any fitness-related goal. Typically, they are used to improve strength, but as you will read below, there is so much more to the squat and deadlift than just lifting heavy weights.

When broken down, each of these exercises is fundamental to human movement. Whether you are training in the gym or are just living your day-to-day life, the squat and deadlift will play an important role. This guide covers topics such as benefits, common muscles utilized, a breakdown of each exercise, common variations, safety considerations, and frequently asked questions you may have. After reading this guide, you should better understand how to perform these exercises safely and effectively.

Benefits of Squats and Deadlifts

Squats and deadlifts are **compound movements** that grant myriad benefits, ranging from **strength**, **hypertrophy**, **muscular endurance**, **flexibility**, and **power**. In addition, the squat and deadlift enhance your ability to perform daily activities, improve body composition, and boost athletic performance (Schoenfeld et al., 2017). For many people, improving daily living activities will be very important. For example, lifting a heavy grocery bag or standing up from a seated position requires similar movements to a deadlift or squat. Including these exercises in your fitness routine enhances your ability to perform such tasks more efficiently, decreasing the risk of injury and improving your overall function (Contreras et al., 2016). These exercises can also greatly affect one's overall body composition. They do this by building lean muscle mass and helping to promote fat loss. More lean body mass will help reduce total body fat, positively contributing to overall body composition. There is also a strong correlation between strength gains from these exercises and improvements in athletic performance metrics such as sprint speed, jump height, and overall power output (Nigro & Bartolomei, 2020; Seitz et al., 2014).

KEY WORDS

Compound Movement –
An exercise or movement pattern that involves multiple joints and muscle groups.

Strength –
The ability to produce force to overcome an external resistance.

Hypertrophy –
The increase in muscle size.

Muscular Endurance –
Ability of a muscle group to sustain repeated contractions against a resistance for an extended period.

Flexibility –
Ability of a muscle or muscle groups to lengthen passively through a range of motion. (ROM).

Power –
The ability to exert maximum force in minimal time. Expressed as force × velocity.

Muscles Worked During Squats and Deadlifts

Squats: Squats primarily target the quadriceps; muscles on front of the thigh. This muscle group comprises four muscles: the vastus lateralis, vastus medialis, vastus intermedius, and rectus femoris **(Figure 1**). Together, these muscles extend your knee and help you to stand up from a squat. In addition to the quadriceps, squats engage the gluteal muscles significantly, including the gluteus maximus and medius (**Figure 2**). These muscles are responsible for hip extension, which occurs when you straighten your hips during the upward phase of the squat.

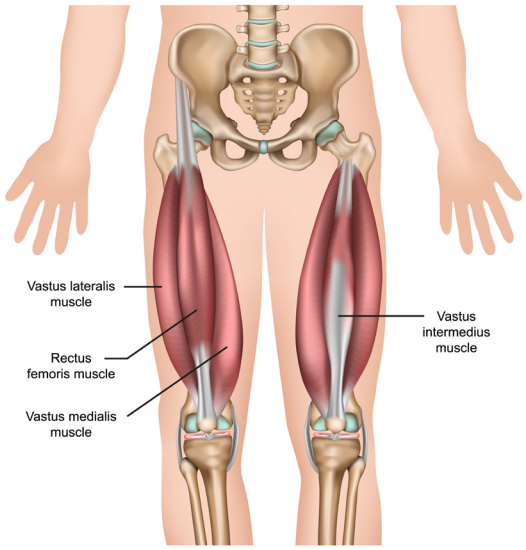


Figure 1. Quadriceps Muscles

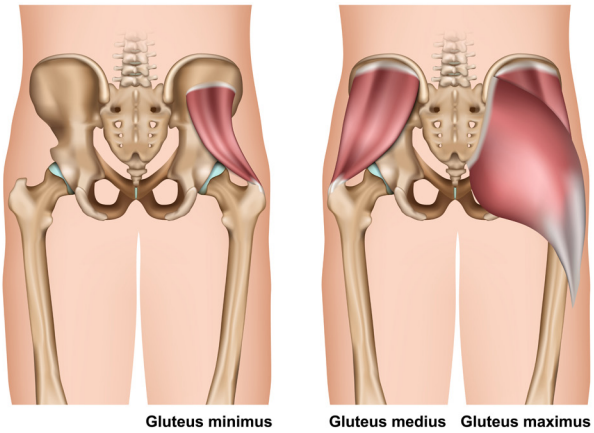


Figure 2. Gluteal Muscles

Deadlifts: Deadlifts target the **posterior chain**, a group of muscles running along the backside of your body. The primary muscles worked here are the erector spinae, a deep group of muscles that run along your spine (**Figure 3**). These muscles extend your spine and help you to lift and hold the weight in an upright position. Deadlifts also heavily engage the gluteus maximus and hamstrings, assisting in extending the hips. The hamstrings consist of three different muscles, the biceps femoris, semitendinosus, and semimembranosus; which are located on the backside of your thighs (**Figure 4**). These muscles are responsible for hip extension and knee flexion, enabling the lifting and lowering of the weight during the deadlift.

KEY WORDS

Posterior Chain – A group of muscles on the backside of the body, such as the hamstrings, gluteals, and erector spinae.

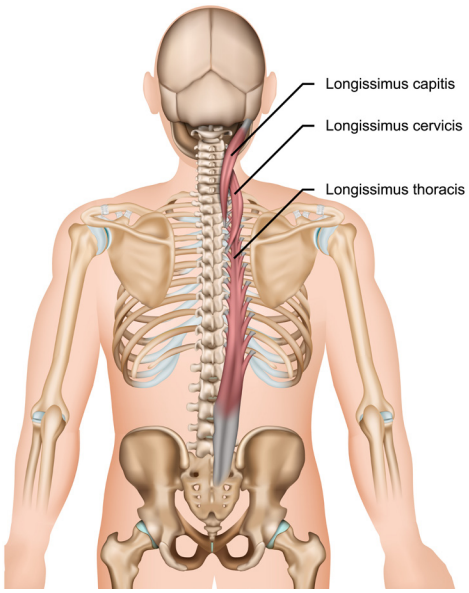


Figure 3. Erector Spinae

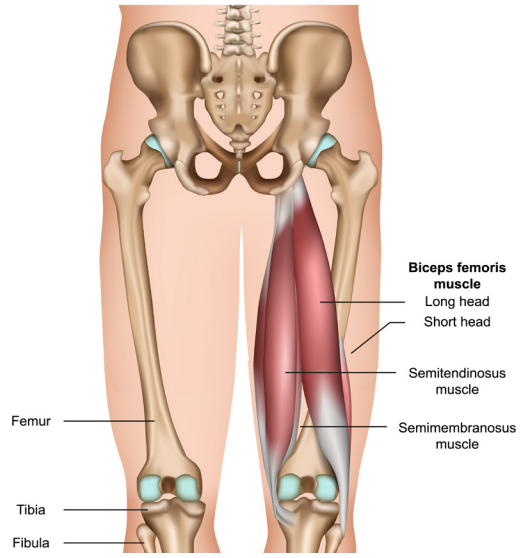


Figure 4. Hamstrings

Introduction to Squats

The squat is a foundational exercise in strength and conditioning. It is the cornerstone of most exercise programs and an essential movement in everyone's day-to-day life. The squat has many variations, but they all share many of the same characteristics. Below, we will discuss the techniques for the traditional barbell back squat, considered by many as the most popular variation of the squat exercise.

Unracking Protocols

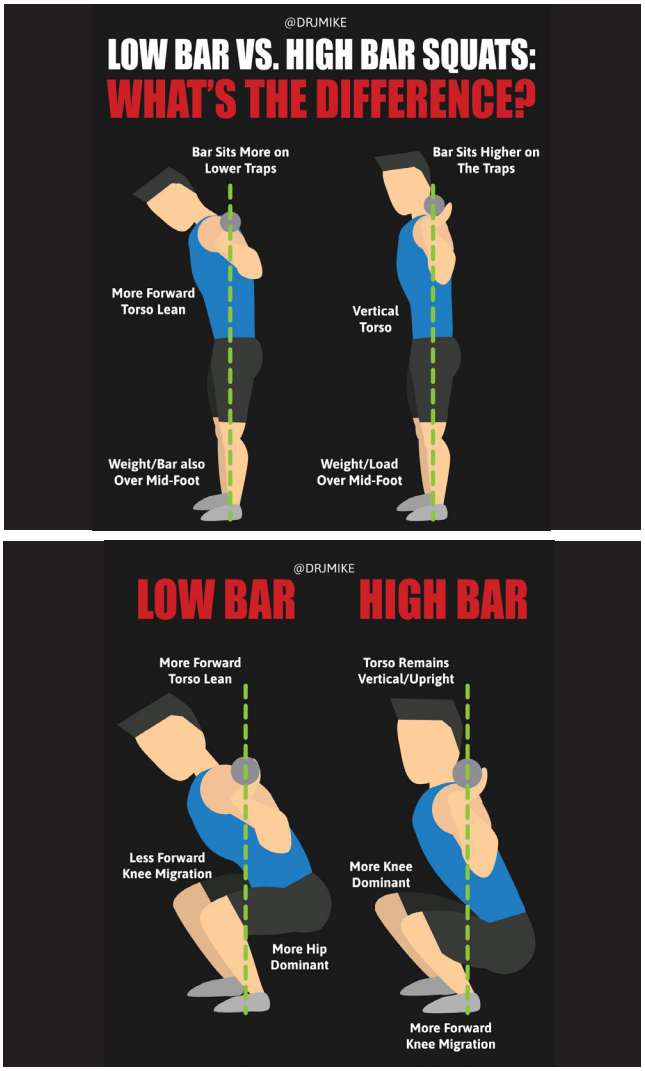


Figure 5. Low Bar Vs. High Bar

Unracking the barbell involves placing the bar correctly on your shoulders and safely stepping into the starting position. The two most common positions are referred to as *low bar* and *high bar* (Figure 5).

- Begin by adjusting the barbell rack so that the barbell sits at around chest height.
- Ensure safety pins are set to an appropriate height. You should use a spotter if you do not have access to safety pins.
- Approach the bar, dipping under it to place it across your shoulders.
- You may choose a high bar position (bar rests on the upper trapezius muscle) or a low bar position (bar rests slightly below the upper trapezius on the posterior deltoid), depending on your comfort and training goals (Swinton et al., 2012). Stand up fully, unracking the bar, take two steps back, position your feet slightly wider than hip-width apart, and **brace** your core.

KEY WORDS

Bracing – Contracting the abdominals to create a rigid midsection, which helps protect your spine.

Correct Movement Patterns

- The squat begins from a standing position, with your chest up, shoulders back, and a neutral spine.
- Start by hinging at your hips, pushing them backward while simultaneously bending your knees.
- Maintain your torso's natural arch and continue descending to a depth based on your flexibility and strength (Clark et al., 2012). For example, some people may have the flexibility and strength to perform a deep squat (thighs parallel to the floor or lower), while others may need to complete a more shallow squat until flexibility and strength adaptations are achieved.
- The individual and their goals dictate the range of motion (ROM); adjust your ROM to what is safe and effective for you.

Equal Flexion of Ankles and Hips

- According to Bryanton et al. (2017), a well-performed squat should include equal hip and ankle flexion. This balance ensures efficient force transfer and can be achieved by bending the knees and hips at approximately the same rate (velocity) throughout the movement.

Neutral Spine and Knee Position

- Maintaining a relatively neutral spine throughout the squat is crucial for preventing lumbar (low back) strain (Schoenfeld, 2010). A neutral spine occurs when all curves of the spine are in optimal alignment.
- Additionally, the knees should track over the second and third toes during the downward and upward phases of the movement to prevent undue strain on the knee joint (Bell et al., 2012). Do not let your knees collapse inward toward each other.

Ideal Squat Depth for the Barbell Squat

- Squat depth can vary depending on individual flexibility, strength, and training goals. However, research suggests that a full-depth squat (hip joint lower than the knee joint) can provide greater activation of the glutes and hamstrings, offering more comprehensive strength development (Caterisano et al., 2002).
- Regardless of what is considered optimal, always adjust the range of motion based on what is safe and effective for you. **Figure 6** provides helpful coaching cues.

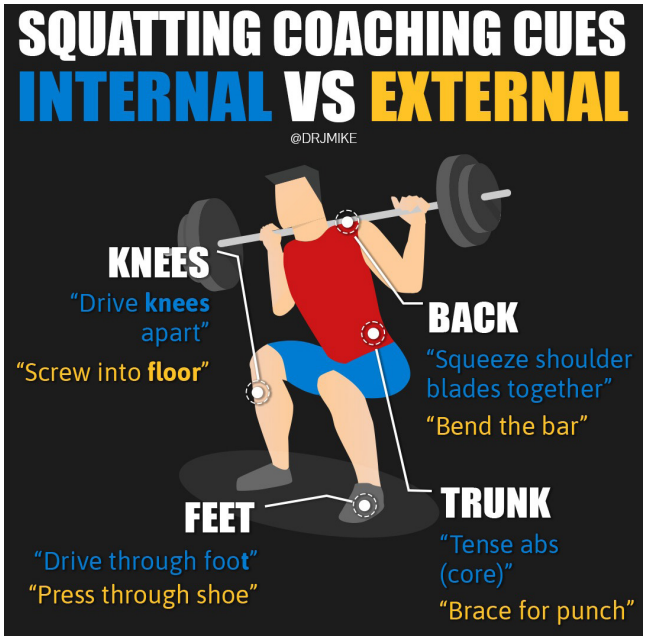


Figure 6. Squat Coaching Cues

Breathing and Abdominal Bracing

- Breathing and abdominal bracing during a squat can significantly impact your performance and safety. Before descending, take a deep diaphragmatic breath, hold it, and brace your core (imagine contracting your abdominals as if you're about to be punched in the stomach). This action creates intra-abdominal pressure, supporting your spine during the lift. Forcefully exhale as you ascend.

COACHES CORNER

Using a Weight Belt

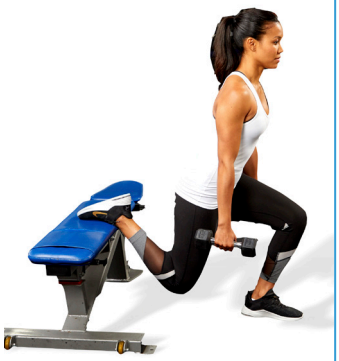
A weight belt can enhance intra-abdominal pressure and provide additional support during heavy squats (Zink et al., 2001). However, it should not replace proper core engagement and should primarily be used by advanced lifters during near-maximal or maximal lifts.

Common Squat Variations

Here are a few examples of common squat variations; this is not an exhaustive list.

TABLE: Squat Variations

Variation	Exercise Description	Link to Exercise Video
Prisoner Squat 	A beginner variation of the squat which utilizes body weight in which the fingers are interlaced behind the head.	https://www.nasm.org/exercise-library/prisoner-squat
Goblet Squat 	A beginner variation of the squat that is performed with dumbbells or a kettlebell held above the elbows.	https://www.nasm.org/exercise-library/goblet-squat

Bulgarian Split Squat 	This is an intermediate variation of the squat where a bench supports one foot (shoelaces down) while the other is on the floor, and dumbbells are placed at the sides. Tension should be focused on the front leg.	https://www.nasm.org/exercise-library/bulgarian-split-squat
Single-Leg Squat 	This is an advanced variation of the squat performed standing on one foot with your hands on your hips. Squat as deep as possible while maintaining proper form. As your fitness improves, you can hold dumbbells to progress the difficulty of the exercise.	https://www.nasm.org/exercise-library/single-leg-squat

Introduction to Deadlifts

The deadlift is a fundamental exercise in strength and conditioning programs used to create impressive whole-body strength. Deadlift variations can target different muscles, accommodate different fitness levels, and keep your training program diverse and challenging. The main deadlift that will be focused on within this section is the traditional barbell deadlift.

Starting Position

- Stand with your feet shoulder-width apart, positioning the barbell directly over your mid-foot.
- Approach the bar, ensuring your shins are close to it without touching it.
- Bend at the hips and knees, keeping your back straight, and grip the bar with your hands slightly wider than shoulder-width apart. Use an overhand or mixed grip (one hand overhand, one hand underhand) for a secure grip on the bar.

Foot Placement

- Position your feet shoulder-width apart or slightly narrower, with your toes pointing straight ahead or slightly outward.
- Experiment with different foot positions to find what feels most comfortable for you. Distribute your weight evenly across your feet, maintaining balance throughout the lift.

Hand Grips

- Choose a grip that feels secure and comfortable for you. The overhand grip is the most common, with both palms facing your body.
- Alternatively, you can use a mixed grip (one hand overhand, one hand underhand) to enhance grip strength and prevent the bar from rolling.

Engagement of Lats (take the slack out of the bar)

- Before lifting the bar, engage your lats by imagining you are trying to bend the bar around your shins.
- This engagement creates tension in your upper body and takes the slack out of the barbell, ensuring a solid connection between you and the weight. **Figure 7** provides helpful coaching cues for initiating the deadlift.

Hip and Spine Position

- The start position requires pushing your hips back, flexing your knees, maintaining a neutral spine, and lowering your torso until your shins touch the barbell.
- Keep your head in a neutral position, looking slightly forward or keeping your gaze on the floor a few feet ahead of you.
- Ensure your hips are slightly higher than your knees, with your shoulders directly over or slightly in front of the bar.

Figure 7 Deadlift Coaching Cues

Correct Movement Patterns

Initiate the lift by driving downward through your feet while simultaneously pushing your hips forward and standing up straight. A helpful cue is to imagine your body is a book and you're opening the book at both ends (pushing your feet into the ground while extending your hips and spine).

- As you lift, keep the barbell close to your body, maintaining a straight vertical bar path.
- Fully extend your hips and knees at the top of the lift, squeezing your glutes.
- Lower the barbell back down by bending at the hips and knees, maintaining control throughout the descent.

Neutral Spine

- Throughout the entire lift, focus on maintaining a neutral spine to minimize the risk of injury.
- Avoid rounding or arching your back excessively, as this can stress your spine unnecessarily.
- Engage your core muscles to help stabilize your spine and maintain a straight, neutral position.

Knees Track Over 2nd and 3rd Toes

- As you perform the deadlift, ensure that your knees track in line with your feet, specifically over your 2nd and 3rd toes. Do not let your knees collapse inward toward each other.

Breathing and Abdominal Bracing

- Breathing and abdominal bracing during a deadlift can significantly impact your performance and safety. Before lifting the bar, take a deep diaphragmatic breath, hold it, and brace your core. This action creates intra-abdominal pressure, supporting your spine during the lift. Forcefully exhale as you lift the bar off the ground.

Common Deadlift Variations

Here are a few examples of common deadlift variations; this is not an exhaustive list.

TABLE: Deadlift Variations

Variation	Exercise Description	Link to Exercise Video
Kettlebell Deadlift 	This is a beginner variation of the deadlift, where a kettlebell is utilized and positioned between both feet.	https://www.nasm.org/exercise-library/kettlebell-deadlift
Dumbbell Romanian Deadlift 	This is an alternative variation of the deadlift in which dumbbells are used (instead of a barbell), and the focus is placed on hinging at the hips and lowering the dumbbells through a maximum range of motion while maintaining good posture. This variation places extra emphasis on the hamstrings and glutes.	https://www.nasm.org/exercise-library/dumbbell-romanian-deadlift
Romanian Deadlift (Barbell) 	A variation of the deadlift in which a barbell is utilized and the focus is placed on driving the hips back and positioning the shins as vertically as possible while balancing the weight evenly over the foot. This variation emphasizes the hamstrings and glutes and is performed similarly to Dumbbell Romanian Deadlifts.	https://www.nasm.org/exercise-library/romanian-deadlift-barbell

Safety Measures During Squats and Deadlifts

Performing any exercise, including squats and deadlifts, requires you to maintain ideal posture and technique to maximize the safety and effectiveness of the movement. We suggest you begin with a comprehensive warm-up to best accomplish this goal. In addition, using a spotter for the barbell squat exercise is recommended.

Muscles to Stretch, Dynamic Warm-up Exercises

Begin with a general warm-up to increase your heart rate and prepare your body for exercise. This can include light cardiovascular activities like jogging or cycling for 5-10 minutes. Perform dynamic warm-up exercises specific to the muscles involved in squats and deadlifts, such as the calves, hamstrings, quadriceps, inner thighs, and hip flexors. These exercises can include leg swings, hip rotations, bodyweight squats, and lunges, to name a few.

COACHES CORNER

If you're familiar with foam rolling and static stretching, these techniques can be useful to improve your range of motion further, especially if you need extra help with your flexibility.

- Begin by performing a few foam rolling exercises for the lower body, such as the calves, inner thighs, and hip flexors. Following foam rolling exercises, perform a few static stretches for the same muscle groups, holding each stretch for 30 seconds.
- Once you're done, proceed with dynamic stretching. Contrary to popular belief, if all three types of stretching are performed in this sequence, you won't suffer any losses to your strength or power output (Behm, D. G., Blazevich, Kay & McHugh, 2016).

Warm-up Sets

Start with a weight that allows you to perform the exercise with proper form and technique. Choose a weight that challenges you but is manageable, enabling you to complete the desired number of repetitions with control. Gradually increase weight as you become more comfortable and proficient with the exercise. If you're unsure about the appropriate weight, it's always better to err on the side of caution and start lighter.

Start with a warm-up set using a lighter weight than your working set. Perform 8-10 repetitions of the exercise, focusing on proper form and technique. This warm-up set helps to activate the muscles and prepare your body for the heavier working sets.

Spotting

If you are lifting heavy weights or training to failure, it's advisable to have a spotter present (**Figure 8**). The spotter should be positioned behind you, ready to assist if needed. Communicate with your spotter about the level of assistance you require, whether it's a verbal cue or a physical lift. The spotter's primary responsibility is to ensure your safety, so choose someone experienced and trustworthy.

COACHES CORNER

- Use proper form and technique to maintain good posture and alignment throughout the exercise.
- Start with lighter weights to practice and refine your technique before gradually increasing the load.
- Maintain control throughout the movement, avoiding excessive speed or momentum.
- Avoid rounding or arching your back excessively, as this can increase the risk of injury.
- Listen to your body and immediately stop if you experience sharp pain or discomfort.
- Ensure that the workout area is clear of any obstacles or hazards that could impede your movements.
- Always have a spotter or use safety equipment, such as safety bars or squat racks, if lifting heavy weights.

Figure 8. Spotting the Barbell Squat

FAQs

How Often Should I Squat or Deadlift?

Squatting and deadlifting frequency largely depend on your training experience, personal goals, and recovery capacity. For novices, performing these exercises 1-2 times per week allows ample recovery and muscle adaptation.

Intermediate to advanced lifters may benefit from increased frequency, even up to three times per week. Yet, balancing volume and intensity is crucial to avoid overtraining and injury (Zaroni et al., 2019). The **muscle protein synthesis** response from resistance training typically lasts 24-48 hours, suggesting a potential benefit of multi-day per week training for each muscle group (Damasceno et al., 2015).

KEY WORDS

Muscle Protein Synthesis – The process of growing, repairing, and building new muscle proteins.

Training Volume – The total amount of work (exercise) performed in each timeframe, typically 1 week.

Intensity – The level of demand placed on the body by a given activity.

Will Squats and Deadlifts Make Me Have Bulky Muscles?

Whether squats and deadlifts lead to "bulky" muscles depends on multiple factors, including **training volume**, nutrition, and genetics. Squats and deadlifts are compound movements that can facilitate muscle hypertrophy but do not necessarily result in a bulky look. It takes many dedicated years of intense exercise combined with a high protein/high-calorie diet to gain large amounts of muscle mass commonly seen in bodybuilders and mass-dominate athletes. In other words, squats and deadlifts are not magic exercises that create bulky muscles, but they are very effective for improving strength, athleticism, and body composition (especially when combined with a diet specific to your goals).

What if I Have Bad Knees / Bad Back?

Squats and deadlifts should be cautiously approached for those with pre-existing knee or back conditions. Consult a healthcare provider before incorporating new exercises if you have an injury. Yet, with proper form and modifications, these movements can help strengthen muscles around the knees and the lower back, potentially improving function and reducing pain (Bressel et al., 2009). In the case of knee issues, partial squats or box squats can be beneficial (Comfort et al., 2018). Trap bar deadlifts can be a safer alternative for those with back concerns, as they place less strain on the lumbar spine (Camara et al., 2016).

Can I Squat and Deadlift on the Same Day?

Performing squats and deadlifts on the same day is feasible, provided training volume and **intensity** are accounted for. It can be beneficial to alternate which exercise is performed first in a session, as fatigue from the first exercise could impact the performance of the subsequent one. Although no true training study currently exists examining the performance effects of performing squats and deadlifts on the same day, deadlifts are often some of the most neurologically taxing movements,

and are often trained less frequently at maximal loads compared to squats. However, proper and strategic program design and exercise selection based on goals should be considered first. Lastly, training both the squat and the deadlift on the same day (or even training them multiple days per week) may likely limit overall strength development over time due to increased neural inhibition.

➔ What is the Ideal Rate of Progression?

The **rate of progression** in squats and deadlifts varies based on factors such as age, training experience, and recovery capacity. Novices may see rapid strength gains due to neurological adaptations (improvements in the nervous system's ability to contract muscles). A common approach is to add 5-10 lbs. to the squat or deadlift every week until a plateau is reached. Advanced lifters, however, may progress slower and require more intricate periodization strategies to progress continually.

Incorporating squats and deadlifts into your workout regime can bring substantial benefits. However, listening to your body, adjusting your training volume and frequency, and focusing on good form over lifting heavier loads is critical.

KEY WORDS

Rate of Progression – The process and speed from which exercise programs increase in intensity, frequency, or volume.

Conclusion

No matter your goal or purpose for working out, the squat and deadlift (and their many variations) will always be ideal choices for exercise. Whether you are a high-level athlete or simply looking to improve your daily life, squats and deadlift are for you. Check out the resources below if you want more health and fitness information.

Recommended Resources

- https://blog.nasm.org/squat-alternatives
- https://blog.nasm.org/biomechanics-of-the-squat
- https://blog.nasm.org/sports-performance/front-squat-back-squat-choose
- https://blog.nasm.org/newletter/diving-deeper-squat-common-misconceptions
- https://blog.nasm.org/powerlifting-vs.-bodybuilding-spot-the-difference

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THANKS FOR READING!

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