WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Science of Squats – An Evidence Based

[1]Mrs. Janetha Jhonson, [2]Mr. Shiva Shankaran, [3]Ms. Swetha

[1]MPT (Cardio), [2,3]BPT Student

[1,2,3]Karlos Sports Science

One effective closed kinetic chain exercise that uses a foot fixed to the ground is the squat. Down phase and lift phase are both included. During the down phase, the trunk and hip move in the direction of the ground i.e., towards the gravity, whereas during the lift phase, the trunk and hip move against gravity between 9 and 140 degrees of knee angle (depending on the type of squat).

There is no accepted standard classification for the depth of squats. It differs between researchers. However, strength coaches frequently divide squats into three basic categories: half squats (knee angles between 70 and 100°), deep squats (knee angles greater than 100°), and partial squats (knee angles under 40°).

In addition to the thighs and buttocks, Squatting exercise for all the core muscles, including those in the abdomen, low back, hips, and thighs.

Squat performance has advantages that extend beyond the sporting community. The squat is regarded as one of the best workouts for enhancing quality of life because of its capacity to recruit many muscle groups in a single movement, which is necessary for the majority of activities of daily living. The science of lifting the body against the body has primarily strengthened the knee and hip extensor muscles, which indirectly enhance the quality of life for both athletes and non- athletes. (BJ Schoenfeld et.al 2010).

Being a multi joint exercise, the squat allows for the simultaneous activation of numerous muscle groups in a more complex manner. Over 200 muscles are activated during the squat (M Solomonow et.al 1987). According to Dr.Michael Mosley's study squatting helps in new brain cells production which will enhance the cognitive function and critical thinking.

Many authors concluded that passing knees anterior to toes in a limited level is safe(Schoenfeld et.al 2010) and prevents stress in the hip and low back, in contrast to many older research that said that knees should not pass in front of toes during squatting. By restricting forward knee travel, Fry et al. (2003) discovered that the stress was simply transferred from the knees < hips < low back. Hence, whereas there was a 22% decrease in knee torque while squatting with limited forward knee movement, there was a 1070% increase in hip torque. It could be the major injury to the low back and hip. And also it is crucial to take precautions to avoid excessive anterior knee movement in order to limit anterior knee stress, which can cause Patello femoral pain syndrome (Kernozek et al. 2017,) and prevent ligament injury. The mechanics underlying patello femoral discomfort and anterior knee movement involve a knee that is leaned more forward in relation to the toes, which increases the Q-Angle (the angle created between the line of the ASIS and line of the tibial plateau) and causes more patella gliding.

MUSCLES ACTIVITY:

The prime agonist muscles activated during squatting are: 1) The tension in quadriceps (Vastus medialis, Vastus lateralis, Vastus intermedius, and Rectus femoris), found to be maximize around 90°. The tension in Gluteus Maximus is found between 20-90° of knee There is less tension around 140° only due to Vastus lateralis & Gluteus maximus. (Paulo Henrique Marchetti et,al.2016).

Synergist muscles (muscles that support agonists) activate during squatting:

1) the role of Hip flexors is concentric contraction to stabilize the pelvis and bring the hip towards the ground. And distal to the knee

In deep squat): iliacus, psoas, pectineus, rectus femoris, and sartorius

2) The Knee flexors need to work concentrically during the down phase: Biceps femoris, Semitendinosus, Semimembranosus (hamstrings), Triceps surae(Gastrocnemius, Soleus, Plantaris) (R.Nisellet.al 1986)

3) Adductor magnus: Graves et al, 2005

Plays crucial role in compensating anterior tibial plateau force.

Potential energy stored in gluteus, hamstrings, adductors during deep down phase ultimately converted into kinetic energy during lift phase –more muscle group generate more muscle force that aids in strength training.

Stabilizer muscles include: Transversus abdominis, multifidus, trapezius, rhomboids, internal oblique, rectus abdominis, external oblique, and pelvic floor muscles.

Core muscles – Debbie et al 2022

Squats activate the ERECTOR SPINAE (Longissimus thoracis, Iliocostalis lumborum, Spinalis thoracis) four times more than planks – Roland van den Tillaar et al 2018.

AGONISTS	**SYNERGISTS**	**STABILIZERS**
QUADRICEPS	HIP FLEXORS	ABDOMINAL MUSCLES
GLUTEUS MAXIMUS	KNEE FLEXORS	MULTIFIDUS
ADDUCTOR MAGNUS	-	TRAPEZIUS & RHOMBOIDS
-	-	PELVIC FLOOR MUSCLES

It has been demonstrated in numerous studies that changing the squat exercise's components led to different muscle activity. The adjustments include:

1) FOOT PLACEMENT (A Paoli et.al 2009)
2) BARBELL POSITION (JC Gullet el.al2009)
3) DIFFERENT LEVELS OF INTENSITY OF LOAD (RR Aspe et.al 2014)
4) STABILITY OF THE SURFACE ON WHICH THE EXERCISE IS PERFORMED (JM McBride et.al 2010)
5) LEVEL OF FATIGUE (SK Andrews et.al 2016).

DEEP SQUATS:

Authors (Neitsel et al 2000, Liu et al 2007, Amin et al 2010) stated that For anyone with hip or knee osteoarthritis (OA) or a ligament or soft tissue injury, squatting is completely contraindicated. Researchers (Dahaghin et al. 2009, Coggon et al. 2000, Amin et al. 2008) has linked prolonged deep squatting (30mins) to a higher risk of knee OA and patella-femoral degeneration. And in patients with osteoarthritis (OA) or previous knee injuries, it's crucial to avoid deep squats.

According to a different perspective, half squats can stimulate the quadriceps and cause an anterior force to be generated in the tibial plateau. The gluteus maximus – the activation of gluteus increases with increase in squat depth (Journal of Strength and Conditioning,2002), hamstrings, and adductor magnus, however, become active as the squat deepens, which produces a posterior force at the tibia proximal end. There will be less of a danger of harm as a result of the anterior and posterior forces being balanced and by reducing shear force.

TYPES OF SQUATS INCLUDE: (Easy to hard)

1) Wall squats
2) Assisted squats with TRX
3) Single leg TRX assisted squat
4) Simple air squat
5) Goblet squats or sumo squats
6) Split squat (lunges)
7) Pistol squat (partial)
8) Overhead squat
9) Front barbell squat
10) Up back barbell squat
11) Low back barbell squat
12) Deep pistol squat

GUIDELINES FOR THE EXECUTION OF A SQUAT:

1) Shoulders in slightly retracted position

2) Foot stance of shoulder width or wider

3) Maintain flat feet in both down phase and lift phase

4) Toes pointing forward or slightly outward but not more than 10° (Myer GD et.al 2014, Comfort P et.al 2007)

5) The knees can move anteriorly (in relation to toes) and medially/laterally but in minimal level only.

6) After completing down phase, push the heel upwards without lifting it from ground and bring back the body to starting position.

7) Maintaining LOG in the mid foot gives proper balance while squatting.