

Effect of CrossFit program for improving the Ankle Joint Balance in Deep Squat upon the Two Olympic Lifts Records

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Introduction

Balance is generally defined as the ability to maintain the body's center of gravity within its base of support and may be categorized by either static or dynamic balance. Optimal posture control requires sensory information from the visual, vestibular, and proprioceptive nerves. The absence of any of these sensory inputs can influence body sway during static balance. (4), (22)

Posture control requires sensory information from the visual, vestibular, and proprioceptive nerves. The decrease of any of these sensory inputs can affect body sway during static balance. Balance training has been used after injury to re-establish basic neural perception to enhance proprioceptive function and kinesthetic awareness (Kang 2013).

For elite weightlifters, the improvement of strength and balance plays a critical role in their performance. They must control extremely heavy weights above head height for a couple of seconds, while their arms are fully extended. Any kind of muscle imbalance and inappropriate technique may hamper athletes' performance and lead to dangerous situations.

In other words, if the lifter is out of balance forward during the lift, it's going to exacerbate the ankle issue. This is why the overhead squats and heaving snatch balances are so important.

This is definitely a situation that's going to require a lot of experimentation on part, and likely plenty of frustrating training days and setbacks. Landing on the toes is different from not being able to

squat down without the heels lifting. And if the landing on toes, the way would need to then settle into the squat would be more demanding of ankle mobility than if the landing was landing flat-footed with feet right under the lifter where they should.

Balance is one of those skills that you probably don't think about honing every day, but it's so important for everyday health. It's essential for helping you move throughout life so you can do everything from picking up a weight in a workout class, to reaching for your favorite pair of shoes at the very top of your closet. Even basic things like walking require us to have a certain sense of balance.
(14)

Improving balance is important for overall fitness and everyday activities, it increases overall movement function. Basically anything that challenges the center of gravity will improve the balance, this can include lifting and holding one of extremities at a time/or unstable surfaces such as Bosu balls. Balance work is also great for bodily awareness, beside balance requires a significant amount of mental focus .
(15)

For the uninitiated, Olympic weightlifting involves two fancy ways of bringing a barbell from the ground to over your head: the “snatch” and the “clean & jerk.” During a competition or a workout, the snatch is performed first, as it’s generally considered to require more finesse, while the clean & jerk comes second as it’s generally considered to require more raw power. An athlete’s clean & jerk is almost always heavier than the snatch.

Each of the exercises requires a pull from the ground, which activates the core and the entire posterior chain (hamstrings to upper back). The quads are worked in the squat while the shoulders and arms are used to whip the bar overhead.(16)

Olympic weightlifting involves tremendous power production and motorskill coordination throughout the body which may prompt unique sensory information acquisition and integration adaptations. In a comparative study between runners, the results showed the identification

of better balance performance by the OWL, particularly when visual inputs were unavailable (i.e., EC), compared to the RUN. These results suggest that Olympic weightlifting may provide a superior training stimulus for somato sensory and vestibular function compared to running in middleaged adults, a benefit that may help to offset archetypal agerelated balance deficits. Just as Olympic weightlifting needs balance, it also develops.(5)

So, in learning and practice of snatch, from the sport of Olympic style weightlifting the barbell is pulled from the floor to overhead and caught in deep squat. Many of the skill are the same for the other Olympic lift the clean where the bar is caught on the shoulders; the study will be used from both lifts. The move is initiated by the performer, which according to Gentile (Schmidt & Weisberg, 2000) makes this a closed motor skill. It is an object manipulation functional involving the change of position of a barbell (Magill 2007), requiring action correct management and the adjustment of the body position to counteract in the –balance created by the object and conforms to skill definitions, a learned ability, maximum certainty, minimum of time and energy with predetermined results and, according to Schmidt& Weisberg (2000) produce as a functional of practice.



Figure (1) the Snatch Balance

The snatch is a ground based multi joint weightlifting exercise, the athlete exert large multiple muscle group force whiles standing on his own feet thus developing balance and coordination: the speed develops the nervous system (Warhammer, 1958) requires a triple extension at the ankle knee and hip, a jumping athletic movement, demands the athlete recruits

muscles in a synchronized pattern, develops explosive power. The larger muscles are mainly used, making this a gross motor skill, requiring both gross motor and psychomotor ability (Magill, 2007).

This is where it becomes evident that without a balance of strength and mobility throughout the body, not only will the performance suffer, but increasing likelihood for suffering an injury, as well. When we place load on positions of dysfunction (such as in the bottom of a Squat for someone with limited hip/ankle mobility) it will increase his risk for injury. CrossFit became a super popular workout a few years ago when box gyms began popping up not only across the country, but the world. (6), (7)

These movements are actions that you perform in your day-to-day life, like squatting, pulling, pushing etc. Many workouts feature variations of squats, push-ups, and weight lifting that last for predetermined amounts of time to help build muscles. This varies from a traditional workout that may tell you how many reps to do over any period of time.

CrossFit workouts are so effective because of their emphasis on the elements of load, distance and speed, which help participants develop high levels of power. The workout may utilize different equipment to accomplish this, including kettle bells, rowers and bikes, medicine balls, speed ropes, rings and plyoboxes.

CrossFit is similar to Orange Theory in that there is a standard "workout of the day" (WOD) that all members complete on the same day "CrossFit is universally scalable and modifiable for all fitness levels, so it can be tailored to meet the goals and current fitness level. (25)

Study Problem

During the completion of weightlifting of Alexandria University championship it was noticed that some lifters in the team did not achieve their lifts weights, and by investigating the reasons for this deficiency, it was found that the landing in the deep squat position is not technically correct, and with reference to the literature and some preliminary

measurements, it was found a deficiency in the ease of movement in the ankle joint ligaments, entailed by negatively mobility that affects the dynamic balance of the quadriceps in Receiving load.

While the in snatch balances it is a dynamic snatch receiving position exercise that adds more demand on technique, also the triple position in clean and jerk lift needs importantly mobility and balance within Extension on the ankle joints precision.

From the kinetic analysis of the two states it is clear that balance and mobility of the ankle joints considered being importance in accomplishing the two lifts in a sound technical manner, and for this reason the current study aims to develop the technique and the weight of lifts by developing and upgrading the interactive balance and mobility in the performance of the two lifts.



Figure (2) Clean in full squat balance

Balance is critical in Olympic lifting. Athletes with limited mobility cannot safely do through a full range of motion and balanced in dynamic movements. What commonly seeing is lifters who are strong from the first and second pulls, but then are unable to finish the lift because of mobility deficits of the ankle ligaments in the receiving positions. Also, athletes with limited mobility cannot safely do through a full range of motion during competitions. They then become more likely to be injured when their bodies need to get into those positions during training, practice or competition.(26)



Figure (3) Snatch Balance

Olympic weightlifting is a demanding sport. Not only do the movements require power and strength, they have underlying flexibility and mobility needs that every lifter must be aware of. **Improving flexibility in Olympic weighting can be done by first assessing the limitations of the lifter, and programming a flexibility routine that can be done before or after training (in addition to mobility and corrective exercise that go along with any movement issues).** (8),(23)

Purposes of the study:

The current study aims to diagnosis and suggests means of correct and develops the defect in motion of the ankle ligaments that causes imbalance in lift technique, as well as the lack of ease of movement in the abduction and knee, in order to improve performance and avoid injury. (17)

Hypothesis:

From the previous context of the study problem, the following conclusion can be reached: **“The higher the level of equilibrium and mobility of Ankle joint, the greater the record of weightlifted.”**

Mobility is the potential for motion of a body segments, joint systems or muscular systems, and the ability to produce that motion through a full range.(66:14)

Weightlifting requires an immense amount of mobility to achieve lifts with proper technique and form. Incorporating my mobility practice into my strength training routine has also made my joints and tissues much stronger and resistant to fatigue.

(27)

Dynamic Stability is the ability of a joint system to resist change or deviation from a desired range while moving through a desired range.

Stability Training

Stability training is a type of exercise training program that helps to strengthen and steady the body's core muscles so that all other extremity movements (arms and legs) are more easily performed. It is sometimes called core stability training because such training concentrates on the core muscles of the upper body, excluding the neck, head, and arms. The completion of stability training provides for increased muscle endurance, along with added tendon and ligament strength and better range of motion for joints and muscles. Generally, stability training is used as a foundation to a larger fitness program, one that provides for enhanced performance, added muscular strength, and reduced risk from injuries.

Importance of the study:

It's clear that the Need of Flexibility is critical in Olympic Weightlifting. Flexibility (and ankle, knee, and hip mobility) is necessary to assume low and stable positioning in the deep squat of the snatch and clean, while chest, lat, and triceps flexibility (and shoulder and thoracic mobility) is needed to properly stabilize loads overhead in the snatch and jerk. The snatch requires serious total body flexibility and mobility. Every joint in the body is needed to promote movement and stability. Common issues with snatches are limitations in lower body flexibility (hamstrings, calves, and quadriceps) as well as tight lats, triceps, and thoracic immobility.

Limitations in hamstrings, calf, and quadriceps flexibility can impede proper joint function of the ankles, knees, and hips; as well as manipulate positioning of the pelvis that can create a cascading detrimental effect throughout the core and spine.

(28)

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Flexibility **ensures that different parts of the body are working together for optimum performance**. Good standards of flexibility should mean better lifts, and also make injuries less likely, with the body more able to cope with the stresses and strains of weightlifting – the most physically demanding of sports.(29)

Methods and procedures:

Participants: Twelve weightlifters presented the total sample of the study; eight players presented the experimental group in this experimental study (one group designed) beside 4 weightlifters as exploratory group.

The study was conducted within 1/1/2020 to 15/6/2021 on a sample of weightlifters from students of the specialty of weightlifting at the Faculty of Sport Education for men, Alex. Universities registered with the Egyptian Weightlifting Federation, ages 20 to 22 years were screened for the eligibility criteria. University healthy weightlifting players, with 3 or more years of competitive experience, practicing regularly for minimum 2 hours/day for at least 3 days/week and not involved in any balance training program apart from their typical sports training were included in the study. Recreational soccer players, and those who reported vestibular problems, low back pain or lower limb injuries that required treatment or that may have impeded performance in the past year, those who had undergone lumbar spine or any lower extremity surgery in the past 6 months were excluded from the study. A written informed consent was obtained from each participant.

Procedures:

An initial examination including demographic data and anthropometric variables such as BMI, limb length and leg dominance was carried out prior to the study. They participated in assessment of dynamic balance using the Y Balance Test – Lower Quarter (YBT-LQ) The Subjects performed the tests wearing their choice of shoes (excluding the balance testing, which was completed barefoot). The first day of testing consisted of anthropometrics and the balance measurements. The second day was used for the modified balance Test. To account for diurnal variation in fitness abilities, all the tests were performed at the same time (4-6 PM). The measurements were conducted in weightlifting room.

Programing schedule of training:

By using circuit training the intensities and volumes are determent as follow: the exercise that aimed to develop the maximum strength arranged from 85% to 100% And more, as the scientist of training suggested that 85% 1Rm is the effective intensity maximum strength, where the maximum strength volume its about 5 sets x 5 reps., while devolving power the subjects ranged from 50% 1RM to 60% 1RM and the volume was 3 sets x 5 Reps each round.

In general the exercises of training program confirmed on hypertrophy of muscle in the first period to endure the next heavy loads of training. The 1RM was determined by using Epley`s equation looks like this: $1RM = \text{Weight} (1 + \text{Reps}/30)$ so, using The load volume 3 sets x 10+ reps by intensity 65% 1RM.

As example one unite of training is: 3x5 70%, 3x5 70%, 3x5, 70%, 3x5 75%, 3x5 70%, 3x5 70%. Of the flowing exercise (front squat, Back squat, Bench Press, Half squat, deadlift, power snatch, power jerk, push press).

The classic lifts (snatch & clean and jerk) additionally to mobility and flexibility exercises and polymeric exercises were used to develop explosive strength.

In regard to developing balance the overhead squat and heaving balances wall set and half boot. Also, standing on oscillation bases by one and two legs, jerk split, one led jerk, side step ups.

Each result was recorded in each participants diary to check up the loads every applied unite to modify the next doses.

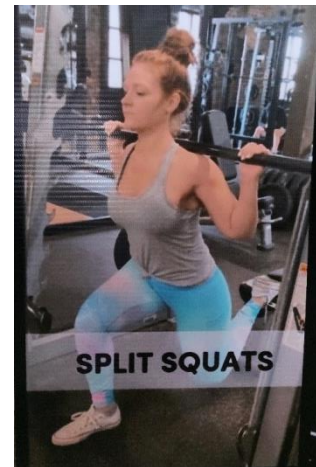


Figure (4)
Side Step Ups

Figure

(5)

Split

Squats

Tools of collecting data:

Measurements and tests used in addition to anthropometric measurements, and general physical measurements, special physical measurements were taken in the weightlifting training room in faculty of

Sport Education for men Alexandria University which are: firstly, the follow specific specific measurements:

- I. Lean Classic test, Jerk Classic test, Front Squat test, Back Squat test, Power snatch test, Power clean test, Power classic test.
- II. Y Balance test for mobility, Range of motion of the ankle joint, thigh muscle circumference, Goniometry was used to determine bilateral ankle active-assistive range of motion (AAROM) and passive range of motion. Balance capabilities were measured with the Functional Reach Besides, text translation to the Mobility Y Balance into Arabic.
- III. The skills performance and lifts records, including records of snatch lift, record of clean and jerk lift, and he total record of the two lifts.

The Y Balance Test – Lower Quarter instructions:

Y Balance Test (YBT) is a simple, yet reliable, test used to measure dynamic balance

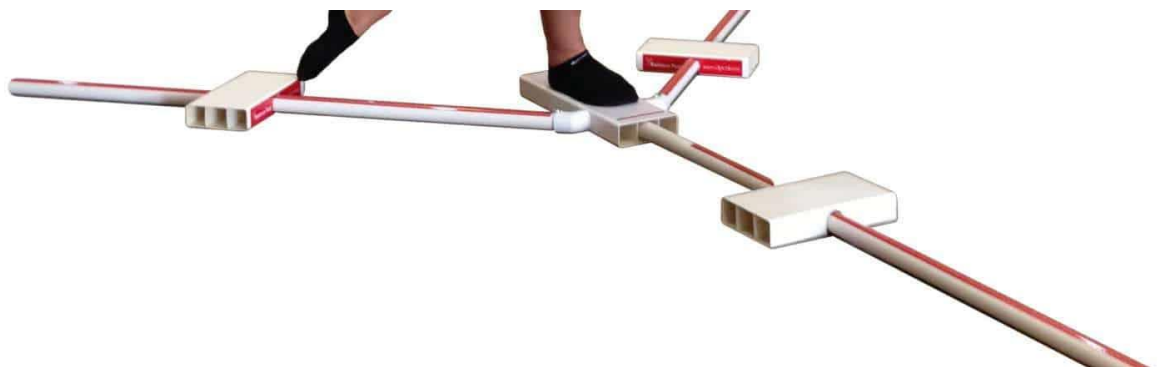


Figure (6)
Y Balance Test, dynamic balance

The Y Balance Test (YBT) is a simple, yet reliable, test used to measure dynamic balance. It was developed to standardize the modified Star Excursion Balance Test (mSEBT), improve it's practically, and make it commercially available. Since then the YBT has gone on to become an extremely popular test due to its simplicity and reliability



Figure (7) Balance Test apparatus

Why use the Y Balance Test in this study?

Balance, otherwise known as ‘postural control’, can be defined statically as the ability to maintain a base of support with minimal movement, and dynamically as the ability to perform a task while maintaining a stable position (6, 7). In a chaotic sporting environment, the ability to maintain a stable position is vital not only for successful application of the skill, but to also reduce the likelihood of injury (8, 3, 4). As a result, it may be of great interest to test and monitor an athlete’s dynamic stability. Also the test has been shown to have strong relationships with knee flexor and hip abductor strength.

(30),(31),(32), (33),(34),(35)(36),(37),(38)

Procedure: conducting the test:

It is important to understand that whenever fitness testing is performed, it must be done so in a consistent environment (e.g. facility), so that it is protected from varying weather types, and with a dependable surface that is not affected by wet or slippery conditions. If the environment is not consistent,

The reliability of repeated tests at later dates can be substantially hindered and result in worthless data. So the researcher relatively neutralized the variables around the test environment test.

Required Equipments for testing:

- Reliable and consistent testing facility (minimum 2×2 meters).
- Test administrator(s)
- Y Balance test kit, or sticky tape and a measuring tape.
- Performance recording sheet

Planning an Effective Warm-Up accordingly to 1RM maximum strength (e.g. the maximum weight can the player lifts it to one repetition):

To plan an effective warm-up, the strength and conditioning coach must first understand the mental, physiological, and biomechanical demands of the training session or sport before they attempt to prepare the athlete for these precise demands. In most circumstances, these demands are identified during the need analysis.

For example, if a strength and conditioning coach is planning a warm-up for some 1-repetition maximum (1RM) testing, then they might want to consider what the mental, physiological, and biomechanical demands of that session are. For mental preparation, the coach may encourage the athletes to arrive well-rested and to bring personal self-motivating music to listen to whilst testing – as this has been repeatedly shown to improve performance. To prepare them physiologically, the coach may adopt a warm-up routine with mimics' similar physiological demands to 1RM testing, such as high-force/strength, long-rest exercises. In terms of biomechanical preparation, stretches, dynamic movements and exercises similar to those being performed during testing would be appropriate (e.g. back squatting) during the technical session. This may include things such as lunges, directional changes, jumping, and twisting movements

Instructions of conducting the test:

The athletes under condition of test asked to were wearing lightweight clothing and remove their footwear as the instruction of the researcher. After doing so, they are required to stand on centre platform, behind the red line, and await further instruction.

After doing so, they are the required to stand on centre platform, behind the red line, and await further

The participants had been asked to performed the test in the following order:

1. Right Anterior
2. Left Anterior
3. Right Posteromedial
4. Left Posteromedial
5. Right Posterolateral
6. Left Posterolateral

With their hands firmly placed on their hips, the athlete should then be instructed to slide the first box forward as far as possible with their right foot and return back to the starting upright position.

Reach distances should be recorded to the nearest 0.5cm. (37)

They should then repeat this with the same foot for a total of 3 successful reaches. After they have completed 3 successful reaches with their right foot, they are then permitted to repeat this process with their left foot.

Once the athlete has performed 3 successful reaches with each foot, they can then progress onto the next test direction (i.e. posteromedial).

The test administrator should be recording the reach distance of each attempt in order to calculate the athletes YBT composite score.



Figure (8)
Acting on Y Balance Apparatus

In regard to the failed attempts the criteria includes the following mistakes:

- The athlete cannot touch their foot down on the floor before returning back to the starting position. Any loss of balance will result in a failed attempt. However, once they have returned to the starting position, they are permitted to place their foot down behind the centre/balance foot box.
- The athlete cannot place their foot on top of the reach indicator in order to gain support during the reach – they must push the reach indicator using the red target area.
- The athlete must keep their foot in contact with the target indicator until the reach is finished. They cannot flick, or kick, the reach indicator in order to achieve a better performance.

Scoring System

With the test complete and all performances recorded, the test administrator can then calculate the athletes YBT performance scores using any of, or all of, the following three equations

- **Absolute reach distance (cm)** = $(\text{Reach 1} + \text{Reach 2} + \text{Reach 3}) / 3$
- **Relative (normalized) reach distance (%)** = $\text{Absolute reach distance} / \text{limb length} * 100$
- **Composite reach distance (%)** = $\text{Sum of the 3 reach directions} / 3 \text{ times the limb length} * 100$

Validity and Reliability

The YBT has proven to have very good levels of interrater test–retest reliability (ICC = 0.80 – 0.85) when measured by entry-level doctorate physical therapy students. In support of this, another study found that ICC (Interclass Correlation Coefficient) for interrater reliability ranged from 0.85 to 0.91 and for intralayerre liability ranged from 0.99 to 1.00. Composite reach score reliability was 0.91 for interrater and 0.99 for interrater reliability.(38)

To make you an expert coach and make your life as easy as possible, we highly suggest you now check out this article on [The Modified BASS Balance Test.](#)

(35)(36),(37),(38)

Statistical Analysis: The following statistical methods were used to reach the results:

Mean. Standard deviation., Paired Samples T test., Percentile %., Sleekness. and, L.S.D.

After the initial measurements the program that is designed conducted on sound scientific principles for ripple load, diversity and active rest, in order to develop some physical abilities related to performance and motor ability through CrossFit programs based on neuromuscular facilities (PNF) to develop dynamic balance for the subjects.. With the help of the Russian program and research regardless of the special programs, the program under study was implemented for a period of weeks at 4 units per week for 10 weeks, including 40 units divided into 4 phases.

The first phase is about checking up the four main specific skills: slow, barbell lifts: squat, push press, bench press, and deadlift; during this period, the subjects go into extensive detail about how to perform these extensive exercises properly and safely. The considered gains during this period, is gaining the flexibility and balance necessary to work with the barbell so that their form is ready when the weights become really heavy just a month or two from now.

After the warm-up sets that start with an empty bar, the squats, press, and bench press are done for 3 work sets of 5 reps each and the dead lifts are done for 1 work set of 5 res. The first day of the protocol was for determining the starting weight for each exercise by means of 1RM and how much weights to add to each exercise each workout. The recovery will be resting about 2 to 5 minutes between work sets and the workouts will be about 30 to 45 minutes long. This first phase lasts about a couple weeks; this phase ends when dead lifts weights are well ahead of squat weights and deadlifts become difficult enough that more recovery is desired between dead lift workouts. Just keep repeating week 1, week 2, week 1, week 2 etc. until the subjects are ready to move on to phase 2, till reaching the phase 4, the last one. The use of depth jumping, bounding and other forms of plyometric training were conducted. (9)

Programming Intensities and volumes of training Classic Lifts:

The snatch balance should be performed with sets of 1-3 reps, typically anywhere from 70-100% or more of the lifter's best snatch (less technically proficient lifters will be able to use greater weights relative to their snatches due to low snatch weights). The exercise is usually performed best in the middle of a training session, after any snatch, clean or jerk exercises that demand more speed and technique, but before more strength-oriented exercises like pulls and squats. They can be performed before snatches with light weights as a technique primer.

Results and discussion:

The results showed a significant improvement at the level .05 of the variables related to dynamic equilibrium in the anterior and posterior direction of the feet alternately.

Table (1)

The significance of the differences between the pre and post measurements in the variables of dynamic equilibrium. (cm)

Variables	Pre-test±	Post-test±	Arithmetic Mean differences	Stander dev.	t value	Improveme nt ratio
Forward D.R. F	51.38± 3.58	56.25± 4.20	4.88	3.94	3.50**	9.49%
Forward D.L. F	47.00± 4.72	54.00± 6.35	7.00	4.93	4.02**	14.89%
Lateral D.R.F.	76.56± 7.68	90.13± 11.22	13.56	9.28	4.13**	17.71%
Lateral D.L.F.	73.00± 12.49	87.63± 15.32	14.63	12.25	3.38*	20.30%
Posterior D.R.F.	66.63± 8.35	89.38± 15.38	22.75	14.86	4.33*	34.15%
Posterior D.L.F.	72.13± 4.37	85.75± 10.11	13.63	9.58	4.02*	18.89%

N= 8

* P< 0.05 t=2.36

**P< 0.01 t = 3.50

- Lateral direction of the right foot
- The posterior direction of the right foot

Table (2)

Static Balance variables (sec)

Variables	Pre-test\pm	Post-test\pm	Arithmetic Mean differences	Stander dev.	T value	Improve ment ratio
Static B.	15.67\pm	21.02\pm	5.35	4.89	3.10**	34.14%
L.F.	3.54	2.73				
Static B.	16.16\pm	21.93\pm	5.77	3.48	4.70**	35.71%
L.F.	3.13	2.02				

N= 8

* P< 0.05 t=2.36

**P< 0.01 t = 3.50

Table (1) clarifies the significance of the differences between the pre and post measurements in the variables of dynamic equilibrium. (cm) where the improvement in forward and lateral direction was consecutively 4.49- 14.89% and posterior from 34.14- 35.71%, while the lateral from 17.71 - 20.30%, and the posterior improving was from 18.89- 39.15%.

Table 2 shows that there are statistically significant differences between the two measurements before and after the experimental program in the constant equilibrium level on the left and right foot

The results of the present study suggest that a 10-week balance-training program would positively affect elite weightlifters' balance ability and flexibility. We think that well-balanced muscular functionality may enhance athletes' sport performance. For elite weightlifters, the enhancement of strength and balance plays a critical role in their performance, since they must control extremely heavy weights above their head height for a couple of seconds, while their arms are fully extended. Any kind of muscle imbalance and inappropriate technique may hamper athletes' performance and lead to dangerous situations.

However, a prolonged clean, jerk motion, which is thought to be the fundamental movement for weightlifting seems to aggravate muscular imbalances leading to higher injury incidence.

(10),(24)

The snatch balance develops strength in the receiving position for the snatch like the overhead squat, but also adds the elements of speed, timing and precision. It will help train proper footwork for the snatch (transitioning from the pulling to receiving stance and reconnecting the feet flat on the floor), and help with confidence getting under heavy snatch weights.

(19)

Secondly, the range of motion variables of the ankle joint:

(3), (21)

Table (3)

The significance of differences between the pre and post measurements in the variables of **the ankle joint- (Geometer –Degree)**

Variables	Pre-test±	Post test±	Arithmetic Mean differences	Stander dev.	t value	Improvement ratio
Triple Ex.	10.31± 1.53	12.44± 1.80	2.13	1.64	3.66**	20.61%
Flexibility 180 L.	10.56± 1.70	12.13± 1.87	1.56	1.64	2.70*	14.79%
Flexibility1 80 R.	10.31± 1.16	12.63± 1.75	2.31	1.83	3.57**	22.42%
Flexibility 90 L.	10.38± 2.07	12.19± 2.00	1.81	1.53	3.34**	17.47%
Flexibility 90 R.	10.38± 2.23	11.75± 2.15	1.38	1.46	2.67*	13.25%
Triple Ex.	10.39± 2.51±	12.13± 1.89±	1.44	1.70	2.39*	13.45%

N= 8

* P< 0.05 t=2.36

**P< 0.01 t = 3.50

- Triple extension of the ankle joint flexibility cm for the left leg (Triple Ex.)
- Flexibility of the knee joint of the left leg at an angle of 180 degrees (Flexibility180 L.)
- Flexibility of the knee joint of the right leg at an angle of 180 degrees (Flexibility180 R.)
- Flexibility of the knee joint at a 90-degree angle for the left leg (Flexibility 90 L.)
- Flexibility of the knee joint at a 90-degree angle for the right leg (Flexibility90 R.)

Extrapolating the results of the previous table, it becomes clear that there is an improvement of between 13.45% to 2242% in favor of the experimental group that was subjected to the experimental program, and significant differences were found in favor of the dimensional measurement in the kinematic range variables represented in the triple extension of the ankle joint flexibility in all measurement angles for the left and right legs At the angles of standing 180 and 90 degrees, as well as in the sitting angles at the angle of 90 degrees, which is the optimal position in the squat in the clouds, as well as in the fixation when receiving the bar in the two lifts, and this improvement leads to achieving the imposition of the study, **“The higher the level of equilibrium, the greater the weight lifted.”**

The following table will clarify the effectiveness of the extent of improvement in the dynamic and static equilibrium variables in simulating the ability to perform with proper technique and the increased ability to increase the weight accomplished in the actual performance and competitions.

Table (4)
The Improvement in the two lifts record. (kg)

Variables	Pre-test±	Post-test±	Arithmetic Mean differences	Stander dev.	t value	Improvement ratio
Clean & Jerk lift	65.63± 14.50	75.25± 19.98	9.63	8.35	3.26	14.67%
Snatch lift	50.88± 13.22	59.00± 18.31	8.13	6051	3.53	15.97%

N= 8

* P< 0.05 t=2.36

**P< 0.01 t = 3.50

The previous table fulfills the hypothesis of the study, and it shows that the applied program of Cross Fit exercises by (PNF) method directed at raising the level of balance for the lifters in a manner in different angles simulating the angles of the actual performance of the two lifts has achieved an improvement ranging from 14.67 % to 15.975 %.

General discussion:

The results clarifying that balance between training different planes of motion is just as important as mobility and strength. The improving in static balance was 34.14-35.71% & and the improving in lifting clean and jerk was 14.67% while the improving in snatch was 15.97% it is due to the current applied training program.

Again, we want our athletes to possess a sense of movement variability; not too rigid so that they're fighting their own bodies, but also not too hyper-mobile that their lifting patterns are loose and inconsistent in nature. Wet noodles tend to fare poorly when under heavy load.

Achieving and maintaining balance between these different aspects can be difficult but is often made easier when we begin to prioritize the athlete's goals, sport and health. Imbalances may seem minuscule when only looking at the global and macro levels of strength and conditioning. However, it's usually in the minor details where we often find the factors that will either lead to breakthroughs in high performance or result in devastating injuries, depending on whether or not they're addressed appropriately.

(20)

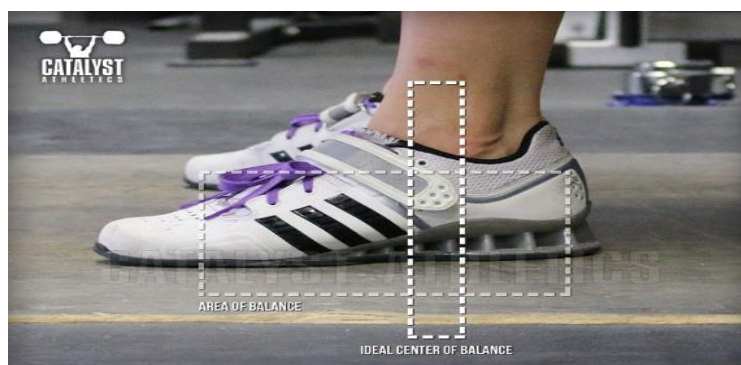


Figure (9) the Ankle Joint

Area of possible balance and ideal location of balance over the foot

This gets more complicated when weightlifter introduces quick and fairly complex movement, as well as an additional chunk of mass that is connected but not fixed in a static position to the lifter. Fortunately, we assume that the lifter is controlling the bar and moving it properly to maintain optimal balance. That allows us to focus on the feet, or really the foot, since all we're concerned with here is where balance and pressure are in a four-aft direction.

The importance of balance during the pull of the snatch and clean:

In the top of the pull of the snatch or clean, lifters will be extended onto the balls of the foot to various degrees, but in virtually every case, the heels will not be in contact with the floor. This has been misinterpreted many times as meaning that the lifter's balance (Log) has shifted forward to the balls of the feet, and is therefore a mistake. However, if the pull is performed properly, the lifter's balance will remain in exactly same place over the foot as the ankle extends—a little behind mid-foot—so that the system's center of mass remains in the same place.

Balance, equilibrium and stability are interdependent, interconnected and inter-conditional attributes, crucial to successful execution of the classic weightlifting exercises. Weightlifters arrange the feet, grasp the barbell and endeavor to shift the feet in the descent under the barbell uniformly equidistant to facilitate balance, equilibrium and stability in the performance of the classic weightlifting exercises.

Conclusion:

Y Balance Test may help identify lower extremity flexibility deficits and flexibility asymmetries in the ankle and hip regions but may need to be used in conjunction with additional tests to understand a broader picture of functional movement and injury risk.

The improvement in dynamic equilibrium was 9.49 -14.89 %, while the improvement in lateral and posterior direction was 17.71- 20.30% & posterior 18.89- 39.15% respectively.

Dynamic balance is one of the important motor skills and is defined as the ability to perform a task while maintaining or regaining a stable

position. So, the results clarified improving percentage ranged from 13-20% in each of Triple extension of the ankle joint flexibility for the left leg (Triple Ex.), Flexibility of the knee joint of the left leg at an angle of 180 degrees (Flexibility180 L.), - Flexibility of the knee joint of the right leg at an angle of 180 degrees (Flexibility180 R.), - Flexibility of the knee joint at a 90-degree angle for the left leg (Flexibility 90 L.), - Flexibility of the knee joint at a 90-degree angle for the right leg (Flexibility 90 R.). Although they are not discussed as much as aerobic and strength-building exercises, exercises to increase flexibility and balance are a key part of a beneficial weightlifting plan.

Muscle Flexibility is largely determined by muscle length when the hamstring is shortened it affects negatively on balance in the dynamic positions.

Also, however, there are no studies, to the researcher's best knowledge, that dealt with components of equilibrium and its impact on the recorded achievement of weightlifters. Olympic weightlifting exercises such as the clean and jerk, and the snatch are commonly incorporated into training programs which allow athletes generating high forces at high velocities, to increasing power (Hori et al., 2005). Yet, the Olympic lifts are very complex and contain a high degree of technical difficulty (Win wood et al., 2015). These exercises require also greater core stability and overall dynamic body balance (Bryan ton and Bilodeau, 2019).

However, few studies have been conducted which have investigated the effects of simple balance training in this field. One study showed significant correlations between hockey skating exercise and static balance tests, (19) which agrees with the findings of the present study in increased one-leg standing time with closed eyes.

(11)

Another study reported an increase in vertical jump height following 5 weeks of balance training. (20), (12)

However, the present study did not show any significant leg power improvement. In the present study, relatively lower loads were utilized throughout whole exercise program, and the majority of exercises were

based on using subjects' body weight and gym balls. Thus, we recommend dynamic balance training for further performance enhancement. On the other hand, some studies have found instability-induced decreases (60–70%) in force^{21, 22}), and other studies reported more modest decrements (6–10%) in force and power¹¹) or no decrement in force with a dynamic barbell chest press²³). In addition, a small decrement in muscular force and power may not compromise the training effect. Perhaps the extent of instability is a mitigating factor in the depression of force²⁴). Also, an unstable base such as a Swiss ball may permit strength training adaptation if the instability is moderate, allowing the generation of overload forces²²).

There is another reason why this study focused more on muscular balance rather than strength and/or power development. Greater instability seems to challenge the neuromuscular system to a greater extent than stable conditions, possibly enhancing strength gains, which are attributed to neural adaptations. Hence, instability resistance training programs may improve athletic performance, while reducing the incidence of injuries. However, the studies cited above did not focus on instability training.

Balance is generally defined as the ability to maintain the body's center of gravity within its base of support and can be categorized as either static or dynamic balance. Static balance is the ability to sustain the body in static equilibrium or within its base of support^{1, 2}).

(2), (1)

Dynamic balance is believed to be more challenging because it requires the ability to maintain equilibrium during a transition from a dynamic to a static state²⁵).

(13)

The results of the present study demonstrate that upper body back hyperextension, a flexibility factor, significantly increased after the 10-week balance-training program. This supports the suggestion that balance training for stability maintenance linearly increases antagonist activity.

Muscle strength is important for posture, stability, and balance:

Previous studies have shown that individuals with stronger knee and ankle muscles have superior balance ability^{28, 29}). In addition, reduced strength has been linked with poor balance and a higher risk of falls^{13, 14}). The present study showed the training program tends to balance the strength of the subjects without any strength compromise, especially the HS group. As mentioned in the introduction, weightlifters must possess strength since it is directly related to their athletic performance. However, at the end of explosive movement, only absolute muscular balance maintains the weight. Muscular balance without strength loss may be the best strategy for a training program. Weightlifting features a jerk action and left and right balance of strength is easy to change. The longer athletic career comes to the fore. Present study, high school athletic career, such as a higher middle school athlete is higher than the difference of the left and right balance. The balance exercise results show that imbalance in the strength of the right and left sides can be reduced.

Equalized strength gain is critical for the improvement of the athletic performance of elite weightlifters. However, weightlifters and their coaches tend to focus training only on general strength gain. The results of this study suggest that the 8-week balance training program adjusts and maintains unbalanced strength, which may enhance performance.

Recommendations:

- 1) Such an exercise program can be incorporated into a training regime of novice weightlifters to prepare them for technically difficult tasks of the Olympic snatch and clean and jerk.
- 2) Weightlifters should consider that "Articulating through the foot to point and return to a flexed position helps to build ankle strength and agility for jumping and other exercises. Always make sure to not roll onto the arch of the standing foot while working, and rotate from the hips,"
- 3) Elite lifter descends with barbell seemingly too far in front of the trunk and fixes it with modest asymmetry of feet. It is assumed the weightlifter needs to keep the barbell close to the torso in the pull and descent, i.e., balance and stability achieved by moving the

barbell close to the body. By contrast, the weightlifter can move the body to the barbell and still get the job done.

- 4) Correct the concept that the precise disposition of the weightlifter's stance and grasp of the barbell are predicated on the assumption that the strength of muscles on the right and left side of the body are equivalent; and, likewise generate selfsame lifting forces to balance and level the barbell in the act of lifting, **without any checkup.**
- 5) Confirm the recommends of the American college of sports Medicine to incorporate flexibility and balance exercise a minimum of two or three days per week.

Prospective Study needed

From the previous discussion it a must to previous needed in regard to the functional of the ankle joint movement range specially Achilles' tendon.

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