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# EFFECT OF PROPRIOCEPTIVE AND STRENGTH EXERCISES ON CALF MUSCLE ENDURANCE, BALANCE AND ANKLE ANGLE APPLIED: LATIN DANCERS

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***ABSTRACT***

*The aim of the study was to examine the effect of proprioceptive and strength exercises applied in addition to dance exercises on the endurance of calf muscles, balance and ankle angles. Participants were randomly divided into two groups as Training Group (n=14; 7 males, 7 females) and Control Group (n=13; 7 males, 6 females). The training group performed a 12-week training programme that included proprioceptive and strength exercises twice a week, just before dance training. Anthropometric measures, static-dynamic balance tests, single heel rise test and 3D kinematic tests were conducted. When the groups were compared, significant changes were observed in the double leg dynamic balance values of the training group, right leg dynamic balance values of the control group, and left leg dynamic balance values of both groups ($p<0.05$). When ankle angles were compared, the first single heel rise and angle of movement of the last single heel rise values of the training group differed significantly ($p<0.05$). The balance performance and calf muscle endurance of the dancers can be improved with proprioceptive and strength training, which can contribute positively to movements during the dance.*

***Keywords*:** Static balance; Dynamic balance; Heel rise; Latin dancers; Proprioception.

## INTRODUCTION

Dance sport is composed of a different direction and movement combinations (walking, running, jumping, forward movement, backward movement, turning, tip-toeing, heel rising). These movements also help the development of lower extremity strength and flexibility (Wu, 2012). Competitive dance sports include a wide range of dance styles and forms with internationally recognised competition organisations (WDSF, 2018).

Dance sport is primarily divided into two main categories as the Standard (Waltz, Tango, Viennese Waltz, Slow Foxtrot, Quickstep) and the Latin (Samba, Cha-Cha, Rumba, Paso Doble, Jive) categories (WDSF, 2018). Latin dances consist of many movement structures that require strength and flexibility, including different steps, turns, quick movement direction and balance changes performed with a partner in open and closed holding positions (Zaletel, 2020).

For dancers to show their performances, they must successfully perform complex choreographic figures and artistic movements with a complex structure, which requires good postural control (Leanderson *et al*., 1996). Improving the proprioceptive system and balance,

which has an important place in proper postural control, leads to an increase in performance level, reduces the risk of injury, and prevents the recurrence of previous injuries (Rozzi *et al*., 1999; Perrin *et al*., 2002; Kaminski *et al*., 2003; Stefanini & Marks, 2003).

Balance skills depend on three sensory systems under different conditions and to varying degrees. These are proprioceptive (somatosensory), visual and vestibular systems (Crotts *et al*., 1996). Proprioception can be described as innate body awareness and knowing where the body is in space. This body sense is closely related to muscle tone, motion perception and balance. Experts have indicated that the nerve endings transmitting this sense are in our muscles, fascia, tendons, ligaments, joints and skin (Ljubojevic *et al*., 2012). In general, the proprioceptive system allows locomotor ability to function correctly and maintains the muscle tone during movement and sports activity.

In addition, it also helps to perceive different body movements, especially in dance choreographies, and allows static and dynamic balance skills to be made more securely in various movements (paired-single) during the dance performance. It also influences stabilising the joints, which is very important for the prevention of sports injuries. In addition, it helps Latin dancing couples to communicate in dance while performing difficult movement variations (Ljubojevic *et al*., 2012). The more sensitive proprioceptive responses in the lower extremities of dancers also improve their coordination skills (Krasnow *et al*., 2011). Crotts *et al*. (1996) attributed the ability of dancers to stay on one leg with eyes closed longer than non-dancers, to the role of the proprioceptive system in postural control.

Plantar flexion is achieved by the joint movement of soleus and gastrocnemius muscles in the calf. This muscle group is also referred to as the triceps surae muscles (Gray, 1980; Hébert-Losier *et al*., 2009). These muscles not only support walking, jogging, jumping, propulsion, but also helps our body to stand on the toes and to stand upright (Moore *et al*., 2006). Besides, researchers have revealed a significant relationship between plantar flexor strength and static and dynamic balance (Spink *et al*., 2011; Bok *et al*., 2013).

## PURPOSE OF RESEARCH

For joint stabilisation, it is necessary to have sufficient strength, endurance and coordination in the muscles that provide as much stabilisation as the proprioceptive system (Kejonen, 2002). This necessity becomes prominent in dance sports, especially in static and dynamic movements, such as turning and positioning. It is believed that body balance and endurance of calf muscles influence ankle movement during dance and this effect will be in the form of inward or outward rotation of the ankle. The aim of our study was to examine the effects of proprioceptive and strength exercises applied in addition to dance exercises on the strength of calf muscles, balance and ankle angles.

## METHODOLOGY

### Participants

The participants were randomly divided into two groups as the training group including 14 Latin dancers (7 males and 7 females) and the control group including 13 Latin dancers (7 males and 6 females). The average age of the training group dancers participating in the study was 25.91±4.07 years, their average weight was 60.60±11.57kg, their average height was 170.19±8.64cm, their body mass index and body fat percentage averages were 20.72±2.27kg/m² and 18.21±5.67 kg/m², respectively. The average age of the control group

dancers was 23.49±3.94 years, their average weight was 66.05±6.55kg, their average height was 171.36±7.15cm and their body mass index and body fat percentage averages were 22.44±0.95kg/m² and 20.79±8.02kg/m², respectively.

Participants were included when they actively engaged in the discipline of Latin dancing for a minimum of 2 years. They participated voluntarily in the study; aged over 18 years and under 35 years and without significant injuries prior to the 6 months. Participants had to be free of illness and not taking any medication that may affect balance, and attending training at least twice a week. Participants were excluded from the study when their data did not meet the necessary conditions for analysis. During the movement analysis test, the data of one dancer in the training group (1 male dancer) and another dancer in the control group (1 female dancer) were excluded from the evaluation as they did not provide the necessary conditions for the analysis.

## Procedures

The measurements were conducted in the dance hall of the Dance Sports club. After the pre-measurement of both groups (training-control) were conducted for the study, a 12-week training programme was provided for the training group, which included Latin dance training, as well as proprioceptive and strength exercises. The exercises were designed in a circuit training concept for12 weeks that include a different movement at each station based on studies examined in the literature (Zech *et al*., 2010; Brachman *et al*., 2017).

The circuit training exercise was planned to reduce local muscle fatigue and increase the rest time between sets. The development of balance and strength was targeted in the programme created. Unstable equipment, such as bosu ball, balance disc and balance cushion were used during the training sessions. The duration of the proprioceptive and strength training was about 30 minutes and it was revised every two weeks (Appendix 1). The intensity of training was determined by increasing training duration, number of movements and sets in a harmonious manner.

While the training group performed the prepared proprioceptive and strength exercises twice a week just before the dance training, the control group continued their routine Latin dance training with the training group. The regular dance training includes technical and choreographic work of Latin dances (Samba, Cha-Cha, Rumba, Paso Doble and Jive). After the 12-week training, the same participants who had the pre-measurement were also given the post-measurement based on the same procedure. This completed the measurement phase of the study.

## Measurements

### *Anthropometric tests*

The body weight and height of the participants were recorded with a Seca 769 branded electronic stadiometer with a precision of 0.1. Skinfold thicknesses were taken from the biceps, triceps, subscapula, suprailiac regions using a Holtain brand calliper for body fat percentage of all participants in accordance with anthropometric measurement standards. In the study, the kg/m² formula was used for the body mass index of the participants and the body density was found by using the formula, which was adapted according to the age of women [BF=1.1599-0.0717*(log(bic+tr+ss+si))] and men [BF=1.1631-0.0632*(log(bic+tr+ss+si))], developed by Durnin and Womersley (1974) and the number calculated was used in the formula of Siri (1961), %fat=(4.95/BF-4.5)*100 in order to calculate the body fat percentage.

***Static Balance Test***

The balance error scoring system-BESS (Riemann & Guskiewicz, 2000; Bell et al., 2011) was applied with the balance test. In the test, the participants were asked to maintain their test positions for 20 seconds without any support under six different conditions with their eyes closed. The test includes two different surfaces (flat and foam) and three standing positions (double leg, single leg and tandem). A medium density foam block (Airex Balance Pad, Alcan Airex AG, CH-5643 Sins/Switzerland) with dimensions of 50x41x6cm was used as the foam surface. All participants applied the six conditions of the test in the following order: Flat surface: double leg, single leg and tandem stance; foam surface: double leg, single leg and tandem stance. Every mistake made by the participants in a period of 20s was recorded as 1 error point.

***Dynamic Balance Test***

The right, left and double leg were evaluated in the system programme using the Libra (Easytech, Prato, Italy) balance device. The device was set at a level of 40cm for measurements. Participants were asked to stand in the central equilibrium position by following the visual and acoustic feedbacks for 30 seconds after getting on the device. Thirty seconds rest were given between each test measurement. In the measurements, three applications were made for each participant's double, right and left leg and the best score close to 0 was included in the evaluation (Boccolini *et al*., 2013).

***Single Heel Rise Test***

The single heel rise test, which is commonly used in many studies in the literature (Hébert-Losier *et al*., 2009a; Hébert-Losier *et al*., 2011), was used to determine the strength of the calf muscles (gastrocnemius and soleus) of the dancers. The participants were asked to hold their non-dominant foot in the free foot position, while lifting the heel of their dominantly used foot as high as possible from the ground with the metronome tempo set at 60 beats (bpm) and lowering it back to the ground. The number of heel rise repetitions were recorded for evaluation (Zellers *et al*., 2017).

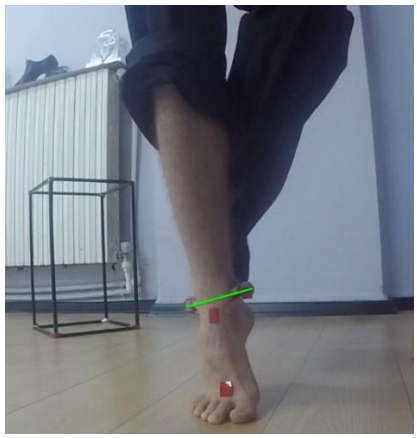

***Figure* 1. HEEL-RISE TEST WITH MARKER PLACEMENT**

### *3D Kinematic analysis*

Three-dimensional kinematic analyses of the ankle of the participants were carried out during the single heel rise test. Markers were attached to the medial and lateral malleolus to determine the movement of the ankle. In the shootings, 2 Go Pro (4 series) branded 60fps cameras and a 40×40×60cm calibration cube were used. The analyses of the obtained images were made using the Simi Motion (Version 8.5.7) programme, and the internal and external rotation angles in the transverse plane were determined in the three-dimensional movement analysis of the ankles of the dancers. Of these values in ankle angle data, positive values were accepted as external rotation and negative values as internal rotation. The first single heel rise, and the last single heel rise were included in the evaluation.

### Analyses

The descriptive statistics of the data were compiled using the SPSS (statistical package for social sciences) 23 statistical programme and the distribution homogeneity of the data was examined using the Shapiro Wilk test. Mann Whitney-U test was used for pre-test-post-test comparisons between groups and the Wilcoxon test was used for within-group comparisons. The significance level was accepted as $p<0.05$.

### Ethical considerations

Prior to the study, the ethics committee approval of Kocaeli University Non-Interventional Clinical Research Ethics Committee 2018/2.22 with Project No: 2018/32 was obtained and the consent form of the participants stating that they voluntarily participated in the study without a physical and mental illness were also obtained. This study was supported by Kocaeli University Scientific Research Projects Coordination Unit as Project Number 2018/027.

## RESULTS

***Table 1.*** **COMPARISON BETWEEN GROUPS AND MEASUREMENT PAIRS OF PRE- AND POST-MEASUREMENT BALANCE DATA**

| Variables | | PRE TEST | | | POST TEST | | | |
|---|---|---|---|---|---|---|---|---|
| | | Group | Mean±SD | p | Group | Mean±SD | p | p2 |
| *Static Balance* | Static Balance Total Score | TG | 12.50±5.76 | 0.533 | TG | 10.79±5.16 | 0.242 | 0.309 |
| | | CG | 10.92±7.16 | | CG | 13.31±5.44 | | 0.336 |
| | Flat Surface | TG | 2.64±2.84 | 0.882 | TG | 2.64±2.76 | 0.403 | 0.964 |
| | | CG | 2.69±2.63 | | CG | 3.46±2.96 | | 0.394 |
| | Foam Surface | TG | 9.86±4.22 | 0.371 | TG | 8.14±3.23 | 0.217 | 0.200 |
| | | CG | 8.23±5.04 | | CG | 9.69±3.12 | | 0.426 |
| *Dynamic Balance* | Double Leg | TG | 5.41±1.11 | 0.732 | TG | 4.24±1.16 | 0.511 | 0.**007** |
| | | CG | 5.64±2.14 | | CG | 4.44±1.26 | | 0.133 |
| | Right Leg | TG | 3.14±0.93 | 0.226 | TG | 2.61±0.87 | 0.922 | 0.069 |
| | | CG | 3.85±1.91 | | CG | 2.56±0.94 | | **0.028** |
| | Left Leg | TG | 3.26±0.87 | 0.810 | TG | 2.49±0.62 | 0.727 | 0.**003** |
| | | CG | 3.88±0.90 | | CG | 2.57±0.61 | | **0.001** |

*Note*: Bold **p** values = significant $p<0.05$ TG=Training Group (n=14) CG=Control Group (n=13)
p=difference between groups p2=difference within groups (pre-post-test)

When the balance data obtained for the training and control groups, pre- and post-measurements were compared according to the groups. It was observed that there was no statistically significant difference between the static balance components; static balance total score, flat and foam floor scores ($p>0.05$) (Table 1).

Similarly, it was determined that there was no statistically significant difference in the double leg balance (DL), right leg balance (RL) and left leg balance scores (LL), which are the components of dynamic balance ($p>0.05$). However, when the within measurement pairs of both groups are compared (Table 1), statistically significant changes were observed in the DL dynamic balance values of the training group, RL dynamic balance values of the control group and LL dynamic balance values of the both groups ($p<0.05$).

In the first measurement of the training and control groups, the number of single heel rise and the ankle angle in the first and last single heel rise were compared (Table 2). No statistically significant difference was found in the first measurement ($p>0.05$), while a statistically significant difference was found only in the number of single heel rise in the last measurement ($p<0.05$). Furthermore, when the within measurement pairs of both groups were compared, it was found that the number of single heel rise of the training group showed a statistically significant increase. On the other hand, when the within measurement pairs of ankle angles were compared, it was determined that the FSHR and LSHR values of the training group had a statistically significant difference ($p<0.05$).

***Table 2.*** **COMPARISON BETWEEN GROUPS AND MEASUREMENT PAIRS OF PRE- AND POST-MEASUREMENT: SHR, FSHR, LSHR DATA**

| Variables | PRE-TEST Group | PRE-TEST Mean±SD | PRE-TEST p | POST-TEST Group | POST-TEST Mean±SD | POST-TEST p | p2 |
|---|---|---|---|---|---|---|---|
| SHR | TG | 46.14±15.32 | 0.512 | TG | 61.36±27.47 | **0.044** | **0.010** |
| | CG | 42.08±16.46 | | CG | 44.08±23.17 | | 0.807 |
| FSHR (º) | TG | 3.48±12.45 | 0.347 | TG | -6.84±8.78 | 0.586 | **0.007** |
| | CG | -1.14±12.56 | | CG | -5.62±11.17 | | 0.335 |
| LSHR (º) | TG | 5.59±14.65 | 0.286 | TG | -6.23±10.44 | 0.574 | **0.046** |
| | CG | 0.18±11.73 | | CG | -3.81±10.81 | | 0.361 |

*Note*: Bold **p** values = significant $p<0.05$ TG=Training Group (n=14) CG=Control Group (n=13)
SHR=Number single heel rise, FSHR= First single heel rise angle, LSHR=Last single heel rise angle

## DISCUSSION

When both the first and the last measurements of static balance values are compared between the groups (TG vs. CG), it was observed that that there was no statistically important difference, but the balance error scores in TG decreased (Table 1). Ljubojevic *et al*. (2017) conducted a study with a total of 38 dancers, examining the impact of proprioceptive training on the quality of dance sports performance. The dancers were divided into two groups, training and control groups. The training group trained 30 minutes three days a week for a total of 12 weeks. A significant difference was found between the two groups and it was found that proprioceptive training had positive effects on the dance sport performance. Twenty-four female dance athletes at the university applied a strength training programme for their core muscles for 9 weeks (three days a week) in addition to their routine dance training.

Based on the measurements, it was found that there was a significant improvement in the tiptoe position, single leg balance performance, the number of turns on one foot, and the star test anterior score of both legs (Watson *et al*., 2017). The analyses applied between the proprioceptive neuromuscular training group and the control group that only performs modern dance training, a significant improvement was observed in the performance of the training group in all balance tests (Tekin, 2013). However, researchers found that 6-week strength and proprioception training did not have a significant effect on muscle strength and static balance (Powers *et al*., 2004). Willardson (2004) reported that strength exercises performed on unstable equipment may not adequately improve balance, proprioception and core muscle, while exercising with free weights on a stable surface improves sports-related skills more effectively.

Although there was no difference between the dynamic balance components (Double-Right and Left Leg) of the groups, the measurement within pairs of the training group were found to be different from each other (Table 2). It was observed that the applied training affects the double and left leg dynamic balance performance in a positive way. In a study, a statistically significant improvement was found in the non-dominant leg balance with open eyes and double leg balance with open eyes after proprioceptive exercise presented to the professional dancers. In addition, an improvement was observed in the dominant leg balance, but this improvement was not statistically significant (Korkmaz, 2007). Alternatively, it has been found that the proprioceptive training applied for 12 weeks improves the ankle stability of young skaters in terms of dynamic balance (Winter *et al*., 2015).

Researchers investigated the effect of neuromuscular training on proprioception, balance, muscle strength, and lower extremity functions of the female handball players and found that there were statistically significant improvement in dynamic balance but no statistically significant improvement in the static balance and muscle strength (Holm *et al*., 2004). Researchers stated that six-week (Mattacola & Lloyd, 1997) and four-week (Akre & Kumaresan, 2014) strength and proprioception training had an effect on the dynamic balance development. Another study stated that the combined strength and proprioceptive exercises were more effective than strength training alone to improve joint stability (Van der Esch *et al*., 2007).

It was found that the number of the single heel rise increased in the post measurements in the comparisons between groups and within groups (Table 2). This shows the positive effect of 12-week proprioceptive and strength exercises on the strength of calf muscles. In a study conducted on the elderly, it was found that the balance training had a positive effect on the calf muscle strength (Maritz & Silbernagel, 2016). Similarly, it was observed that the heel rise training contributes to the development of calf muscle strength and postural control (Fujiwara *et al*., 2011). It has been determined that 12 weeks of aerobic and strength training significantly improved the leg strength, flexibility, dance performance and $VO_2$max of modern dancers (Koutedakis *et al*., 2007). In a study involving ballerinas, it was found that additional strength training performed before dance training improved the leg (hamstring and quadriceps muscles) strength (Koutedakis *et al*., 2004).

The average number of the single heel rise of the dancers who participated in the current study was 53.04±26.508 in the final test. Considering the studies conducted on dancers, in a study, it was found that 97 dancers can rise 33±0.83 times on a single heel. Of these dancers, the ballroom dancers can rise 25±3.73 times, ballet dancers can rise 25±3.72 times, folk dancers can rise 33±3.64 times, modern dancers can rise 26±3.82 and dancers from other branches can rise 31±4.52 times, respectively (Thomas, 2003). In another study conducted on 27 dancers, the participants performed 40 repetitions in a single heel rise test (Alvarez *et al*., 2000). In a

study where the fatigue of the triceps surae muscles and electromyography (EMG) activity were examined during the heel rise test, it was observed that the dance students performed 34.5±16.7 repetitions, and those who do not dance performed 33.0±10.7 repetitions, respectively (Yoshida & Kuno-Mizumura, 2003). In a study where dancers performed 19.7±3.6 repetitions in the single heel rise test, those who do not dance performed 32.5±8.29 repetitions, respectively (Zellers *et al*., 2017).

In the pre- and post-measurement, no difference was found between TG and CG in terms of the first single heel rise and the last heel rise. However, the findings of the study indicate that the ankle angle shows more external (outward) rotation in the transverse plane in the single heel rise in the pre-measurement of TG, and internal rotation is observed in the post-measurement. It is believed that the increasing strength and development of the calf muscles causes the ankle to create an angle towards inward rotation in the transverse plane. Considering the studies in the literature, it has been determined that the dancers have more inversion and joint range of motion angles compared to other athletes from different branches. In a study examined the foot and ankle proprioception of the athletes in different sport codes, the performance of dancers in inversion movement was found to be better compared to hockey, running and sedentary groups (Li *et al*., 2009).

In the within-group measurement pairs, there was a change in the ankle angle of the training group during the first single heel rise in the pre-measurement and the single heel rise in the post-measurement. This change is an internal rotation in the transverse plane. This also applies to measurement pairs (comparison between the first and last measurements) for the last single heel rise. The angle of internal rotation created by the ankle angle can be considered as development. The outward release of the body, especially during rotation in dance, leads to loss of balance. The dancers minimise the outward movement of the ankle as much as possible to avoid this. In this way, they can make more controlled turns or movements. On the other hand, 6-weeks of neuromuscular training has been found to reduce the outward orientation of the ankle angle in motor activities, such as walking, running, and jumping (Kim *et al*., 2017). In a study, balance training was performed with flat stable surface, boom ball, wobble board, and Airex balance pad products, and at the end of the research, a significant difference was found in the ankle inversion and eversion values when balanced on the wobble board and Airex compared to a flat surface (Strøm *et al*., 2016).

## CONCLUSION

The balance performance and calf muscle strength of the dancers can be improved with proprioceptive and strength training, which can directly contribute positively to the dancer's movements during the dance. Obtaining EMG results in the single heel rise test and balance measurements used in the calf muscle strength can also provide information about muscle activation. Dance sport includes movements that require agility and coordination, as well as the use of balance due to its structure. Therefore, it would be beneficial for dance science to examine these features and try new training methods that can contribute to the development of dance performance. Evaluation of the postural analysis would also make the findings of the study more meaningful. Increasing the sample size, creating a category with the number of repetitions of the single heel rise test specific to dance or dance branch, and standardising the test can contribute to new studies to be undertaken.

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## APPENDIX 1: EXERCISE PROGRAMME: PROPRIOCEPTIVE AND STRENGTH EXERCISES

| Exercises | WEEK 1 | | | WEEK 2 | | | WEEK 3 | | | WEEK 4 | | | WEEK 5 | | | WEEK 6 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** |
| Warm up | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec |
| Runner on the Bosu ball (step up and down) | 2 | 20 | 20sec | | | | | | | | | | | | | | | |
| Stand on your Single leg over the Cando Balance disc | 2 | 20 | 20sec | 2 | 20sec | 20sec | | | | | | | | | | | | |
| Lunge | 2 | 20 | 20sec | | | | 2 | 25 | 25sec | 2 | 25 | 25sec | | | | | | |
| Bending and reach straightening on single foot on the Airex balance pad (single leg reach) | 2 | 20 | 20sec | | | | | | | | | | | | | | | |
| Going forward-back with Rocker board while on double legs | 2 | 20 | 20sec | | | | | | | | | | | | | | | |
| Trying to sit and wait on the Theraband balance disc | 2 | 20sec | 20sec | 2 | 20sec | 20sec | | | | | | | | | | | | |
| Jump single foot two times before getting on top of the Bosu ball, then jump onto the Bosu ball with the same foot and wait | 2 | 20 | 20sec | | | | | | | | | | | | | | | |
| Jumping over the Bosu ball to the right-left side | | | | 2 | 20 | 20sec | | | | | | | | | | | | |
| Tandem stance on Airex balance pad | | | | 2 | 20sec | 20sec | | | | | | | | | | | | |
| Squat | | | | 2 | 20 | 20sec | | | | | | | 3 | 20 | 25sec | 3 | 20 | 25sec |
| Going right-left with Rocker board while on double legs | | | | 2 | 20 | 20sec | | | | | | | | | | | | |
| Jump with single foot on the Bosu ball and wait. | | | | 2 | 20 | 20sec | | | | | | | | | | | | |
| Jump with double foot on the Bosu ball and wait | | | | | | | 2 | 25 | 25sec | | | | | | | | | |
| Relevé stance on single leg on the Cando balance disc (foot on the relevé to be held forward) | | | | | | | 2 | 25sec | 25sec | | | | 3 | 20 | 25sec | 3 | 20sec | 25sec |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stand with single foot on the Airex balance pad (with eyes closed) | | | | | | | 2 | 25sec | 25 | | | | | | | | | |
| Supermen position on the Theraband balance disc or the pointer (changes feet and arms with each set) | | | | | | | 2 | 25 | 25sec | | | | | | | 3 | 20sec | 25sec |
| Calf raise | | | | | | | 2 | 25 | 25sec | 2 | 25 | 25sec | 3 | 20 | 25sec | 3 | 20 | 25sec |
| Going forward-back and left-right with Rocker board on double legs | | | | | | | 2 | 25 | 25sec | 2 | 25 | 25sec | | | | 3 | 20 | 25sec |
| Going forward-right-back-left on the flat surface of Bosu ball then Lateral jump with single leg | | | | | | | | | | 2 | 25 | 25sec | | | | | | |
| Monopodal flexion (similar to Pistol squat) | | | | | | | | | | 2 | 25sec | 25sec | 3 | 20sec | 25sec | | | |
| Clock reaches on Theraband balance disc (Star excursion balance test) | | | | | | | | | | 2 | 25sec | 25sec | 3 | 20sec | 25sec | | | |
| Plank | | | | | | | | | | 2 | 25sec | 25sec | | | | | | |
| Pistol squat on Airex Balance pad | | | | | | | | | | 2 | 25sec | 25sec | | | | | | |
| Side to side jumps on Bosu ball | | | | | | | | | | 2 | 25sec | 25sec | | | | | | |
| Mountain climbers on the Bosu ball | | | | | | | | | | | | | 3 | 20 | 25sec | 3 | 20 | 25sec |
| Sit ups | | | | | | | | | | 3 | 20 | 25sec | 3 | 20 | 25sec | | | |
| Lateral jump over the Bosu ball | | | | | | | | | | | | | | | | | | |
| Clock reaches on Airex Balance pad (Star excursion balance test) | | | | | | | | | | | | | | | | 3 | 20sec | 25sec |
| Sit up on Bosu ball | | | | | | | | | | | | | | | | 3 | 20 | 25sec |
| Lateral Lunge | | | | | | | | | | | | | | | | 3 | 20 | 25sec |

| Exercises | WEEK 7 | | | WEEK 8 | | | WEEK 9 | | | WEEK 10 | | | WEEK 11 | | | WEEK 12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** | **Set** | **Rep** | **Rec** |
| Warm up | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec | 1 x | 10min | 10sec |
| Jump on Bosu ball | 3 | 25 | 25sec | 3 | 25 | 25sec | 3 | 30 | 30sec | | | | | | | | | |
| Horizontal balance movement on Cando balance disc (on single leg) | 3 | 25sec | 25sec | 3 | 25sec | 25sec | 3 | 30sec | 30sec | | | | | | | | | |
| Sprint in place on Airex balance pad then first right leg step up and wait, same action but this time left leg step up and wait | 3 | 25sec | 25sec | 3 | 25sec | 25sec | | | | | | | | | | 3 | 30sec | 30sec |
| Plank on Theraband balance disc (right foot open and close then left foot sideways) | 3 | 25sec | 25sec | 3 | 25sec | 25sec | 3 | 30sec | 30sec | | | | | | | | | |
| Squat on Bosu ball | 3 | 25 | 25sec | 3 | 25 | 25sec | | | | | | | | | | | | |
| Push up on Bosu ball | 3 | 12 | 25sec | 3 | 14 | 30sec | | | | 3 | 14 | 30sec | | | | | | |
| Jump and wait on Cando balance disk and theraband balance disc | 3 | 25 | 25sec | | | | | | | | | | | | | | | |
| Calf raise on Bosu ball | 3 | 25 | 25sec | | | | 3 | 30 | 30sec | 3 | 20 | 30sec | 3 | 20 | 30sec | | | |
| Side leg raises on Rocker board (open and close the right foot sideways in the lateral position on rocker board. Then open and close the left foot sideways) | 3 | 25 | 25sec | | | | 3 | 30 | 30sec | 3 | 15 | 30sec | 3 | 20 | 30sec | | | |
| Lunge and then knee (step) up on Bosu ball | 3 | 25 | 25sec | | | | 3 | 30 | 30sec | | | | | | | | | |
| Jump and wait on Balance disk and Theraband disc | | | | 3 | 25 | 30sec | | | | | | | | | | | | |
| Calf raise on Airex balance pad | | | | 3 | 25 | 30sec | | | | | | | | | | 3 | 25 | 30sec |
| Leg raises in anterior position on Rocker board (right leg raises forward on rocker board. Then open and close the left foot forward | | | | 3 | 25 | 30sec | | | | | | | | | | | | |
| Lunge and then knee up on Bosu ball | | | | 3 | 25 | 30sec | 3 | 30 | 30sec | | | | | | | 3 | 16 | 30sec |
| Tandem stance on the Airex balance pad (eyes closed) | | | | | | | 3 | 30 | 30sec | | | | | | | | | |

| | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Side to side squats on bosu ball (jump over the bosu ball then in the side squat) | | | | | | | 3 | 30 | 30sec | | | | | | | | | |
| Up and downs on Bosu ball | | | | | | | 3 | 30sec | 30sec | | | | | | | | | |
| Trying to sit and wait on Theraband balance disc | | | | | | | | | | 3 | 15 | 30sec | | | | | | |
| Squat on the ground then jump to Bosu ball and again squat | | | | | | | | | | | | | 3 | 12 | 30sec | | | |
| Clock reaches on Cando balance disc (Star excursion balance star test) | | | | | | | | | | 3 | 30sec | 30sec | 3 | 30sec | 30sec | | | |
| Burpee on Bosu ball | | | | | | | | | | 3 | 12 | 30sec | | | | | | |
| Wait in squat position on Bosu ball | | | | | | | | | | 3 | 20sec | 30sec | 3 | 30sec | 30sec | | | |
| Reverse sit up on Airex balance pad | | | | | | | | | | 3 | 15 | 30sec | 3 | 20 | 30sec | | | |
| Forward lunge on Theraband balance disc | | | | | | | | | | 3 | 15 | 30sec | 3 | 20 | 30sec | | | |
| Plank knee to elbow cross on Bosu ball | | | | | | | | | | 3 | 10 | 30sec | 3 | 20 | 30sec | | | |
| Push up | | | | | | | | | | | | | 3 | 14 | 30sec | | | |
| Single leg stance on Airex balance pad (eyes closed and change feet with each set) | | | | | | | | | | | | | | | | 3 | 30sec | 30sec |
| Plank with feet on the Theraband balance disc | | | | | | | | | | | | | | | | 3 | 60sec | 30sec |
| Lateral relevé stance on single leg on the Cando balance disc | | | | | | | | | | | | | | | | 3 | 40sec | 30sec |
| Pelvic tilt with the feet on the Bosu ball | | | | | | | | | | | | | | | | 3 | 15 | 30sec |
| Static wall squat | | | | | | | | | | | | | | | | 3 | 30sec | 30sec |
| Going front-back-right-left directions on single leg with the Rocker board (change feet with each set) | | | | | | | | | | | | | | | | 3 | 20 | 30sec |

Rep=Repetition Rec=Recovery min=minutes sec=seconds