

The Effect of a Training Program of Muscular Balance on Numerical Level and Performance of 100 meter Female Runners with hamstring strain

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Abstract: Balance training has evolved into a very important area of focus for our fitness industry. It has become its own section in exercise programs, where it may take someone the rough a series of balance exercises. Many would describe balance as the ability to remain still over a base of support that is small. There are several things to consider when training balance, body position, footwear, training balance in motion, surface, integration of the body and righting vs. Equilibrium reflexes (Nasher, 1997), (Hong and Chan, 2004) . The aim of this study was to investigate the effects of a training program of muscular balance on numerical level and performance of 100 meter female runners with hamstring strain. **Methods:** 10 female players of 100 meter run with hamstring strain volunteered for the study. They performed balance training for three times per week for 12 weeks. Each training unit included of one legged balance and balance exercises which help to train pro-prioceptive system before and after the end of the program, performance tests: vertical jump, maximal isometric strength of the leg extensors was measured with a dynamometer, shuttle run test, stability posture using Biodex stability system together with numerical level of 100 meter run. Statistical analysis using T test was performed $P < 0.05$. The Results revealed an increased value of vertical jumps and improved of isometric lower limb extension strength, and a benefit of shuttle run tests, and improvement of balance test after the proposed program compared to the cases before the program. **Conclusion:** Balance training might improve balance stability of hamstring strain and performance together with improvement of the numerical level of the female runners.

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Key words: Balance training, performance tests, numerical level, female runners , Hamstring strain .

1. Introduction:

Balance is the body's ability to right itself. It is improved with pro-prioceptive feed back. The activities that require balance, coordination, agility and power and movements that challenge the normal range of motion, are great ways to cross-train to pro-prioceptive adaptation (Palma, 2005). Postural equilibrium need pro-prioceptive acuity and precise neuromuscular control. Pro-prioception is the afferent information that contributes to conscious sensation (muscle sense), Posture equilibrium and segmental posture joint stability (Lephart, 1997). Exercise can help to improve a number of sensoriomotor systems that contribute to stability (Lord et al., 1999), Gauchard et al., (2001) reported that pro-prioceptive exercise appeared to have a greater effect on balanced control than bioenergetic physical activities.

Many specialist think that our period is the period of scientific victories in physical education. The evidence is the great achievement in sports, seen in Olympic games, that reach a miracle. The numerical level of different races in track and field has become advanced to an extent that let the specialists asked: where is the limit of human ability? The answer is that there are some factors namely: personal

readiness of the player together with the effectiveness of training plans based on scientific ideas, so the personal readiness and the efficiency of the training plans are the main factors leading to the progress and success of sport (Mahmoud, 2008).

Sprinting is a difficult combination of aggression, relaxation, technique and efficiency. The 100 meter is sometimes labeled as the easiest most complicated event in sport, and contrasting body building, gaining too much size can become a negative. In fact, what's interesting is that some sprinters do not lift weights at all. But for those of us who are not as genetically gifted, the ultimate goal is having incredible strength to weight ratios, lean body mass and a well developed CNS (Central nervous system) for fast reaction and the ability to explode on command (Miah, 2002).

The problem of this study focus on hamstring strains which is probably the most occurrence lesion in muscle injury. Woods et al (2004) demonstrated that this injury accounted for 12% of the total injuries of the muscles, Orchard et al (2001) mention hamstring muscle strain as the most prevalent injury in Australian football, accounting for 16% of playing time missed as a result of injury, Garrett (196) stated

that the injury occur when the muscle is either stretched passively or activated stretch. As for the causes inducing muscle strain,

- 1- Inadequate flexibility
- 2- Muscle weakness .
- 3- Strength imbalance
- 4- Unsatisfactory warm up
- 5- Excessive fatigue
- 6- Disturbed posture (Kujala et al 1997, Johnhagen et al 1994).

Isokinetic devices provide valuable information by allowing valid strength measuring of single joint movements and the development of agonist – antagonist ratio classically calculated on reciprocal peak torques. Bilateral comparison of 15% or more are considered as abnormal for the hamstring muscle group (Croisier et al, 2002). Imbalance refers to a modification of the strength balance between agonist and antagonist muscles (Bennell et al 1998). Logically, a correct balance between performances developed by each involved muscle would be strictly respected in speed athletes. So, balance training, is very important in preventing and curing hamstring strain

This research is an attempt to identify the effect of a training program of muscular balance of hamstring strain on numerical level and performance of 100 meter female runners.

Hypothesis:

1. There are a positive effect of the performance tests strength measurement, shuttle run, stability posture vertical jump for the sake of post exercise program results.
2. There are a positive effect on the biochemical parameters (**Lactate, LDH**) for the sake of post exercise program results.
3. There are a positive effect on numerical

level of 100 meters run for the sake of post exercise program results.

2. Materials and Methods

Methods: 10 female players of 100 meter run volunteered to participate in the study, age (18.4 ± 3.3 years), Height (162.3 ± 3.6 cm) and weight (63.4 ± 2.1 k). The experimental method was used in this study for its suitability to the research objective by using one group. The participants were free of diseases. They all subjected to hamstring strain and volunteered to the study performed on Madinat Nasr club 1/10/2012 -2/1/2013.

Instrument used:

1. Dynamometer for strength test.
2. Biodex for stability test.
3. Accusport for lactate measurement.
4. Stop watch for numerical level detection.
5. Spectrophotometer for LDH lactate dehydrogenase enzyme.

The following parameter were recorded:

- Isometric strength of leg extension.
- Shuttle run. 100 meter run.
- Stability posture.
- Vertical jump.
- Lactate concentration.
- LDH concentration.

General principles:

- Balance is achieved first, then strength.
- Exercise progress from simple to complex.
- Initial exercises are performed slowly and deliberately in controlled situations.
- Advancement is made after the activity is mastered.
- Progression is to more complex activities (Petrella et al, 1997).

Balance exercises (micholalcourt@show.ca)

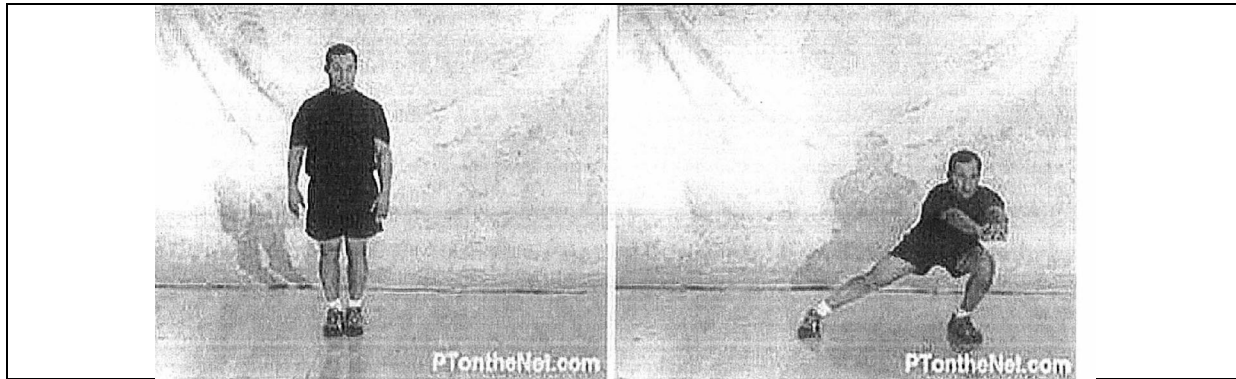


Balance Hold 1 Leg - Overhead Posterior Reach (for maximal proprioceptive stimulus, perform bare foot)

Ensure that the motion occurs at the ankle, knee, and hip complex as opposed to the lower back.

Training Balance in Motion:

Balance is often seen as being static and still. This limited view does not maximize balance. To train balance, we must put our bodies out of balance. For this, we MUST MOVE. Balance training must be view, train, assess, and studied in MOTION rather than in stillness.



Lunge - Frontal w/Anterior Reach

This exercise involves a frontal plane lunge with an anterior bilateral arm reach (as far This exercise involves a frontal plane lunge with an anterior bilateral arm reach (as far forward as can be controlled) at waist height.

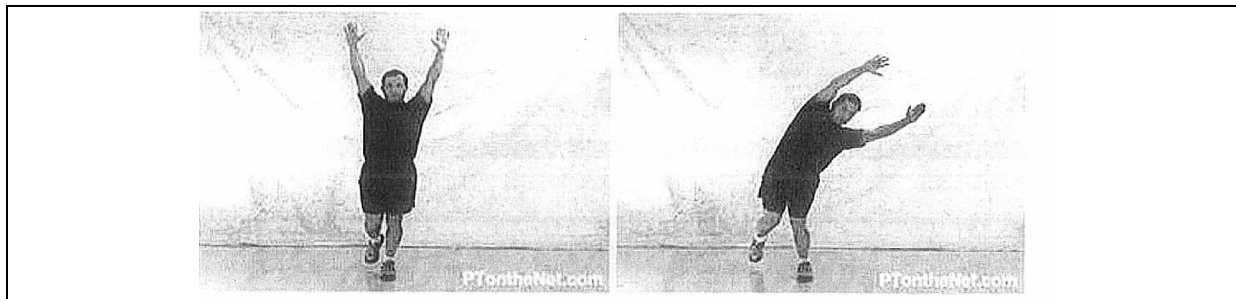
Surface:

In order to maintain balance, our bodies rely on 3 pathways (3 friends). The first is oculomotor (our eyes), secondly, we have our vestibular system (our inner ear), and finally we have our pro-prioception

(nervous System). The trick is that we need at least 2 friends at our party in order to maintain balance.

Integration of the Body

When training for balance, we MUST train in integration, this means exercise movements that involve the entire body. Current research in biomechanics and the nervous system clearly tell us that we are built in an integrated fashion.



Balance Hold 1 Leg - Overhead Lateral Reach

This exercise involves an overhead reach to one side with the knee bent to approx. 20°. Only move to the point of control... never further.

Balance Training vs. Strength vs. Power

In conventional approaches, we always segmented balance training from any other forms (i.e. core, strength, power, etc.). Since we are beginning to realize that balance should be trained in motion, we are starting to train for strength and power simultaneously WITH balance.

This is an excellent way to integrate balance and strength training.

Performance tests

* **Four Minutes warm up** was performed before each test, the subjects wore the same shoes during the three performance tests.

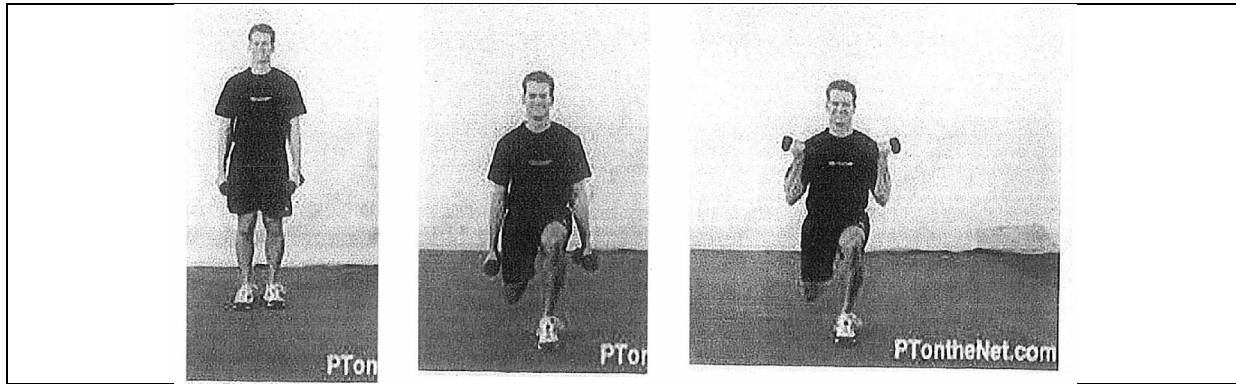
* **A vertical jump test** was performed to assess the lower limb explosive performance capacity, on a

contact platform to measure the flying time, which is used to estimate the height of the rise of body center of gravity. **Maximal isometric strength of the leg extensors** was measured with a dynamometer.

* A shuttle run test over a 30 m course was used, the subjects were asked to run as fast as possible six times between markers placed 4 m apart., and run a 6 m course over the finish line, the running time was recorded.

* **Balance test** was performed using Biodex stability System. The platform provides stability levels. This System provides a numerical stability index that reflects the body sway variation around the body's center of gravity.

Statistical Analysis: The difference between pre-post exercise program was compared by "T" test, mean, standard deviation and $P < 0.05$ was set as statistical significance.



Lunge - Forward w/Bicep Curl

3. Results:

Table (2) indicated the biochemical variables (Lactate, lactate dehydrogenase enzyme) before and after the program, the biochemical parameters showed a decreased concentrations after the end of the program. As for the isometric leg muscle extensor, (Table 1), there was an increased muscle strength results for the favour of post program results performances tests (Table 1) indicated a positive results after the end of the program in shuttle run, vertical jump test and balance test.

Also the participants performed a positive result in 100 meters run after the balance program as revealed in Table (1,2)

Discussion:

The 1st hypothesis stated "there are a positive effect of the performance tests, isometric lower limb muscle extension jump vertical, shuttle run, stability posture for the sake of results post exercise program".

Table (1) indicated that isometric lower limb extension increased after the balance program. The increased data reported may results due to the effect of exercise which acted on the proprioceptors of the muscle, tendon and joint, hence the increased recruitment of the motor units and adaptation of the muscle fibers by increasing its density and mass leading to increase its strength, This result was also reported by **Torvinen et al, (2002); Xu et al, (2004); Lephart et al, (1997)**.

Vertical jump height increased after the balance program, the balance test revealed an improvement in the posture together with

the decreased in the shuttle value expressed in seconds, the possible cause of the positive values recorded in this study may be to the effect of the balance exercise program, leading to adaptation in muscle fibers and mitochondria of the muscles as reported by **Mougios (2006)**, that exercises causes

hypertrophy of the muscles resulting from enhanced protein synthesis, the increase in gene expression inside the muscle fibers is partly due to a higher DNA content due to addition of nuclei derived from satellite cells. He also added that the mechanisms of exercise induced Mitochondrial biogenesis is due to increase number and growth of the size which is controlled by two classes of proteins leading to improve their action. This mechanism of action was also reported by **Consitt et al, (2002); Bassett and Dowley (2000); Rogind et al, (2003); Hwang et al, (2013)**.

Jean -Benoit et al (2012) reported about Mechanical determinants of 100 m sprint running performance and reach the following conclusion that a higher level of acceleration and overall 100 performance is mainly associated with: 1) a Velocity – oriented force velocity profile, likely explained by 2) a higher ability to apply a forward orientation over the acceleration and finally 3) a higher step frequency caused by a shorter contact time.

So the balance training program in this study could developed the key variables, and on the neuromuscular origin affecting the 100m sprint running performance leading to improve the speed for a better result.

Thus, the 1st hypothesis has been realized. **The second hypothesis stated:**

There are a positive effect on the biochemical parameters (lactate and Lactate dehydrogenase Enzyme) for the sake of post exercise program results.

Table (2): indicated that lactate and lactate dehydrogenase enzyme decreased significantly after balance exercise program. The decreased parameters were due to the positive effect of the exercise program which increased Mitochondrial numbers and sized leading to increase oxygen level inside the mitochondria and decreasing lactate production and lactate dehydrogenase enzyme indicating a higher fitness of the participants. This result is in accordance

with **Mohamed, (2012); Fitts, (2004); Greenhaffand Timmons, (1998).**

Lactate is the end product of anaerobic carbohydrate breakdown. It is the metabolite displaying the most spectacular concentration changes in muscle and the blood with exercise. As a result, its measurement offers a wealth of information regarding the effect of exercise on metabolism and indicated higher fitness of the participant, the lower, the lactate concentration the higher its fitness (**Mougious, 2006; (Nieman, 2003; Roth and Brook, 1989).**

CHatterjea and Shinda, (2006) stated that LDH catalyzes the reversible conversion of pyruvic acid and lactic acid and its normal range from 60 to 250 IU/L and it increases during conversion of pyruvate to lactate during anaerobic glycolysis.

They also added that fates of lactic acid in the body is its conversion to pyruvate and its utilization as pyruvate which either undergoes oxidative decarboxylation to form Acetyl CoA or it can be glucogenic.

Dubouchard (2000) reported the role of MCT_i and MCT₄ in human skeletal muscle as exporter gene and importer one of lactate also they indicated the physiological role of LDH in lactate metabolism.

Thus, the 2nd hypothesis has been realized. **The 3rd hypothesis stated:**

There are positive effect on numerical level of 100 meters run for the sake of post exercise program result. The result of the study was in accordance with **Amany and Mohamed, (2011)** as 100 meters run numerical level decreased.

The positive effect of 100 meters run numerical level may be due to the relation of gene factors which affect muscle type whether white muscle fiber (fast) or red muscle fiber (endurance). The speed is affected by genotype of muscle such as Actinin 3 or ACEDD in this case the player is gifted for speed, but in case of the genotype Actinin 2 or ACEII, the player is gifted for endurance.

This opinion is in accordance with **Abo El Ella, (1993); Enas, (2007); Bouchard and Fox, (2000); Walfarth, (2001); Mohamed Kamal, 2010).**

Thus, the 3rd hypothesis has been realized.

Conclusion:

Balance training might improve balance, stability of hamstring strain and performance together with improvement of the numerical level of the female runners.

Table (1) : M + SD Performance tests before and after balance training: (N=10)

Parameters	Before M+SD	After M+SD	Sig.
Shuttle Run (S)	12.1 + 0.89	10.1 +0.2	S*
Maximal isometric strength leg extensors (K)	19.1 +19.2	198.2 +20.2	S
Vertical jump (cm)	37.3+3.8	39.7+3.2	S*
Stability posture	3.5+1.2	3.0+1.3	S
100 meters run (S)	13.7+0.7	13.2+0.8	S

P<0.05

Table (2) : M + SD biochemical parameters before and after balance training:

Parameters	Before M+SD	After M+SD	Sig.
Lactate m mol/L	1.5 + 0.5	0.9 +0.03	S
LDH EU/L	153.1 +12.4	121.2 +9.4	S

P<0.05

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