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# THE EFFECT OF CORE STABILIZATION TRAINING PROGRAM ON ELDERLY POSTURAL CONTROL

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**SUMMARY**

As hygienic principles are increasingly considered, longevity and elderly population augments in consequence. Sixty females recruited from a total of 200 and aged more than 60 years (70.6 ± 6.0 yrs, 55.8 ± 5.8 kg of weight and 157.8 ± 7.8 cm of height) were classified as low falling risk and high falling risk. Then, these subjects were randomly divided into two experimental and control groups. A week prior to starting the training program, their balance status were measured with the Berg balance test (BBT) and compared with independent and dependent t-tests. The experimental group followed a core stabilization program of three days per week, for eight weeks. At the end of this period, they performed better ($p<0.05$) than the controls. The training program had also better effects on the high risk group. Significant differences were observed for balance following the training program, in both the anteroposterior and mediolateral planes ($p<0.05$). In conclusion, significant differences were shown in improving balance and postural control after a related training program in elderly women.

**Key words:** Core stability, postural control, falling risk, elderly

***ÖZET***

*GÖVDE STABİLİZASYON ANTRENMAN PROGRAMININ YAŞLILARDA POSTÜR KONTROLÜNE ETKİLERİ*

*Hijyenik temellere dikkat arttıkça, yaşam süreleri ve buna bağlı olarak da yaşlı popülayonu dünyada artmaktadır. Bu çalışmada 60 yaşını geçmiş ve 200 birey arasından seçilmiş toplam 60 kadın (70.6 ± 6.0 yaş, 55.8 ± 5.8 kg vücut ağırlığı ve 157.8 ± 7.8 cm boyda) düşme risklerine*

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*göre düşük ve yüksek ve riskli olarak sınıflandırıldılar. Daha sonra rastgele şekilde deney ve kontrol gruplarına ayrıldılar. Antrenman programına başlamadan bir hafta önce dengeleri Berg denge testiyle ölçüldü ve elde edilen değerler bağımsız ve bağımlı t-testleriyle karşılaştırıldı. Deney grubu sekiz hafta boyunca haftada üç gün bir gövde stabilizasyon programı uyguladı. Programın sonunda deney grubu kontrol grubundan daha iyi ($p<0.05$) sonuçlar elde etti. Antrenman programı yüksek risk grubunda daha etkili oldu ve denge parametresi açısındam gerek anteroposterior, gerekse mediolateral düzlemlerde antrenman ve kontrol grupları arasında anlamlı farklılıklar ($p<0.05$) ortaya kondu. Sonuç olarak, yaşlı kadınlarda uygun bir antrenman programı uygulamanın denge ve postür kontrolünü geliştirmede anlamlı farklılıklara yol açtığı söylenebilir. Gövde stabilizasyon egzersizleri postür kontrol kaslarını kuvvetlendirerek dengeyi güçlendirir.*

***Anahtar sözcükler:*** *Gövde stabilitesi, postür kontrolü, düşme riski, yaşlılık*

## INTRODUCTION

Upon increasing consideration of hygienic principles and following them, longevity and elderly population augments in the world. According to Swedish statistics, 17% of the world's population consisted of elderly people in 2006, and this rate was anticipated to increase to 25% in 2030 (14). For developing quality of independent life along with increased elderly society, detecting and preventing health problems of elder people is crucial. Elder citizens must enjoy the benefits of physical, psychological and social health. Therefore, preventing elderly disability, assessing elder people's problems, and considering factors that affect quality of independent life are increasingly important topics.

Daily physical activities require postural control and specific movement components (15). Postural control and balance are indicators that assess independence in daily activities. To increase quality of independent social life in the elderly; considering and detecting factors that effect changes of postural control in order to increase performance in daily physical activities, and preventing injuries that occur upon falling is very important. Aging is associated with deficits in the neurological, vestibular, and visual systems. It is also associated with loss in muscle strength. This, in itself, would be a limiting factor in daily activities. For the older populations, the most immediate concern is simply accomplishing activities of daily living (ADL).

Losses in reflex ability and of strength in the rectus abdominis, transversus abdominis and external obliquus muscles reduce functional

ADL in people over 60 years of age. Studies have shown that strengthening core muscles does aid functional abilities. This increase in functionality translates better into performance of ADLs, which in turn leads to greater psychological gains by allowing the person to be more independent (11). Studies have revealed the role of core stability in improving performance. Clark and coworkers (2) have suggested that core stability supports maintaining postural alignment during functional activity, which helps preventing serial distortion patterns and leads to improved performance. Leetun et al (7) suggested that core stability is one of factors related with lower extremity injury. Core stability training is also one of the main parts of rehabilitation of back pain patients (5,9).

Petrofsky and coworkers (10) reported that core stability training programs can significantly affect static balance. Johnson et al (6) revealed significant positive effects of four weeks of trunk muscles strengthening program on the balance of healthy people. Whereas Samson et al (13) found that five weeks of core stability training program affects dynamic balance significantly, Swaney and Hess (16) observed improvements in the posture of swimmers who accomplished nine weeks' long core stability training program, with no significant effects on dynamic balance. Lewarchick et al (8) reported that seven weeks of core stability training did not affect footballers' balance significantly, but enhanced functional performance.

There are diverging reports about the effects of core stability training programs of different duration and kind on balance. Most studies were carried out on athletes, and a kind of sport training accompanied the core stability training protocol. In view of this divergence, and because of the potential and obvious importance of core stability training on the balance and postural control of the elderly, the purpose of this study was to study the effects of a core stability training program on postural control in an elderly population.

## MATERIAL and METHODS

Sixty elderly and healthy women (70.6 ± 6.0 yrs of age, 55.8 ± 5.8 kg of body weight, 157.8 ± 7.8 cm of height) chosen from 200 people participated in the study. A week prior to starting the program, balance status was assessed with the Berg balance test (BBT), and subjects were classified as low falling risk and high falling risk individuals, based on scores obtained in the BBT. The Berg balance scale (BBS) was developed to measure balance among older people with balance function impairment

by assessing performance of functional tasks (1). A ruler, two standard chairs (one with arm rests, one without), a footstool or step, a stopwatch or wristwatch, and 15 ft walkway are required.

A five-point scale, ranging from 0 to 4 is used for the 14-item scale, "0" indicating the lowest function level, and "4" indicating the highest function level, giving a maximal possible score of 56. The range of 41 to 56 is interpreted as low falling risk, 21 to 40 as medium falling risk, and 0 to 20 as high falling risk. A change of 8 BBS points is accepted to reveal a genuine change in function between two assessments among older people who depend on ADL.

A three-dimensional force plate (Advanced Mechanical Technology, Inc., Watertown, MA, USA) was used to measure the center of pressure (COP). The COP anteroposterior and mediolateral ranges of displacement were analyzed for the combined situations of one-legged and double-legged stances, randomly repeated three times for both the closed and opened eyes situations.

The experimental group followed a score stabilization program that included three levels for eight weeks, three times per week on alternate days, with 30 min in each session. BBT was repeated at the end of the training period. Independent and dependent t-tests were used to analyze data ($p<0.05$), through the SPSS v13 statistics program.

The core stability training program was divided into three sections. The first week program consisted of simple exercises as finding neutral position, sitting stabilization, prone gluteal squeezes, supine pelvic bracing, pelvic progression, side bridging, knee stabilization and supine bridging. "Physioball" exercises for the core were introduced in the following weeks: abdominal crunch, balancing exercise while seated, "Superman" prone exercise, modified push-up, pelvic bridging. Core strengthening exercises were performed in the last weeks: body weight and gravitational loading (push-ups, pull-ups, rope climbs), body blade exercises, medicine ball exercises (throwing and catching), dumbbell exercises in diagonal patterns, core stretching exercises, balance training on a labile surface, squats, and lunges.

## RESULTS

The COP displacements for the three trials in double- or single-legged stances and the opened or closed eyes conditions are given as means ± SE of the mean for the anteroposterior and mediolateral planes, in Table 1.

**Table 1.** Pre- and post-test BBT scores in terms of center of pressure (COP) displacement (cm) as means ± SEM of the three trials in the anteroposterior and mediolateral planes

| | Anteroposterior | | Mediolateral | |
|---|---|---|---|---|
| | Pre-test | Post-test | Pre-test | Post-test |
| OE, both legs | 5.36 ± 0.62 | 2.30 ± 0.55* | 2.70 ± 1.27 | 2.20 ± 2.10* |
| CE, both legs | 3.17 ± 0.71 | 2.52 ± 0.30* | 3.11 ± 1.76 | 2.15 ± 1.69* |
| OE, one leg | 7.18 ± 3.77 | 5.48 ± 1.44* | 4.80 ± 3.12 | 4.28 ± 1.96* |
| CE, one leg | 16.3 ± 3.86 | 16.0 ± 3.55 | 16.2 ± 4.91 | 11.2 ± 3.56* |

OE, opened eyes; CE, closed eyes; * indicates difference statistically significant between before and after training period ($p<0.05$).

Pre- and post-test BBT scores for the low falling risk and high falling risk classified experimental and control groups are given in Table 2, as means ± SD.

**Table 2.** Pre- and Posttest Berg Balance Test scores for the low- and high- falling risk groups, and their controls (as means ± SD).

| Group | Subgroup | Pre-test | Post-test | Mean difference |
|---|---|---|---|---|
| Low falling risk | Experimental | 53.2 ± 1.9 | 55.0 ± 1.1 | 2.10 ± 0.87 |
| | Control | 52.6 ± 1.8 | 53.1 ± 1.7 | 1.10 ± 0.56 |
| | p-values | 0.486 | 0.007 | 0.007 |
| High falling risk | Experimental | 38.5 ± 1.3 | 44.3 ± 2.1 | 5.80 ± 1.61 |
| | Control | 37.8 ± 1.0 | 39.2 ± 1.3 | 1.40 ± 0.51 |
| | p-values | 0.193 | <0.001 | <0.001 |

Whereas no significant differences were observed for balance prior the training program within the experimental group ($p>0.05$), such differences were obtained following the training program in both the anteroposterior and mediolateral plane COP displacements ($p<0.05$), and the BBT scores (from $p=0.007$ to $p<0.001$). The high falling risk individuals had obtained more significant benefits ($t=6.48$, $p=0.006$) upon completing the treatment protocol.

## DISCUSSION

It is known that aging is associated with loss in muscle strength. Muscle strength is lost not only in extremity muscles such as the gastronemicus, but also in the core muscles of the body, resulting in increased body sway and balance difficulties (10). Core stabilization

training strengthens these muscles and improves balance and postural control. Anatomically, the core is where the center of gravity is located, and most movements begin from there (7). Therefore, strengthening these muscles by means of core stabilization training improves the neuromuscular system, and results in a decrease of the ratio of the area in motion at the center of gravity, thus reducing sway. Such training protocols can be applied at home, and target key muscles in the abdominal and lower back area, translating into an increase of muscle strength and functionality in all three directions.

Standard exercise programs limited to stretching may not be as effective in increasing functionality. In studying the effect of core stability training on balance, Craps et al (5) stated that 20 sessions of core stabilization training program significantly affected static balance, in line with the work of Johnson and coworkers (6), and Clary et al (3) who showed that core stabilization training may improve balance.

The present study results correspond with those of Petrofsky et al (10), reporting that four weeks of core stability training program affects elderly balance significantly, as well as with the results of Cosio-Lima and coworkers (4), which revealed that five weeks of core stability training program with Swiss ball and floor exercises improved balance. In contrast, Lewarchick et al (8) reported that a seven-week core stability training program did not affect balance of footballers significantly, and Swaney and Hess (16) stated that nine weeks of core stability training did not affect balance of swimmers significantly.

Although the nature of the core stabilization training programs were similar to the present one in the above mentioned studies, variables such as subject age and activity rate might have affected the results. In fact, Swaney and Hess (16) and Lewarchick et al (8) had used athletes for their experimental groups, and healthy subjects as their controls. In addition, balance was assessed by a functional test in the present study, but through laboratory methods in the other studies.

In order to support daily living functional activities, specific examples of effective programs are presented (10). On the other hand, the duration of core stabilization training per session, and the total duration of the core stabilization training program in various studies is different, and no specific protocol can be pointed at for the best effect (12). The present study results may indicate that core stabilization training programs can improve balance, and they may be used with

other training programs with conditioning, rehabilitation or performance increasing goals.

Improving balance and postural control is very important in elderly people and affects the quality of their life. The purpose of this study was to assess the effect of a core stabilization training program on balance in elderly women, and the results appeared to be promising. To conclude, significant improvements in balance and postural control ($p<0.05$) were obtained following the training program that was applied in elderly women Still, further study is needed to be done in this field.

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