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The effect of aerobic exercise on improvement of motor functions in healthy elderly

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ABSTRACT

Aging is a natural phenomenon on that effects on different systems of our body. This process is not due to diseases and accidents. Activity of Daily Living (ADL) is important for elderly persons. The objective of this study was the effect of aerobic exercise on improvement of motor function in healthy elderly, after eight weeks of regular participation in walking. The 36 elderly female with age above 60 years old participated in this study. 18 elderly female in exercise group with mean age of 66.32 and 18 elderly female in control group with mean age of 67.22. The exercise group participated in aerobic exercise program for eight weeks. Functional 30-second chair stand test and 10-meter walk test were conducted to evaluate motor function. The Independent T-test and paired sample T-test was used to compare the differences between the pre and post-test in both groups. All statistical analyses were performed using SPSS statistical software version 19. Results showed significant difference in the assessed data of the exercise groups in the posttest level in comparison with the pretest level. Therefore, walking is appropriate for improve of motor function in elderly female.

Keywords: Aerobic exercise, Gait speed, Strength of lower limb

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INTRODUCTION

Ageing is the result of complex interactions between genetic, metabolic, hormonal, immunological and structural factors which affect cellular and tissue levels and bodily systems as well as their function, consequently leading to oldness (6). During the past century, the number and proportion of older adults among the world population has increased due to socio-economic developments and better medical services (27, 43). One of the most important changes occurring in aging is the loss of muscle mass. Longitudinal studies suggest that during older age, muscle mass decreases about 3% to 6% per decade (9, 31). The reduction of muscle mass associated with aging seems to be the primary factor responsible for reduction in muscle strength and power and the consequent loss of functional mobility in elderly people(18, 21, 74). It has been well-established in the literature that there are reductions in muscle function and level of physical activity (LPA) concomitant with aging (50, 56). Associations between measures of muscle mass and function, LPA and functional mobility have been established in older adults, demonstrating that slow walking speed and reduced handgrip strength (HG) can identify those with reduced lower-limb muscle strength and power, limitations and functional decline(14, 38, 53, 64). As older individuals become more physically or psychologically impaired their mobility performance and skills tend to decrease. Further, physical impairments such as loss of bone and muscle mass can often occur as a result of decreased mobility. Balance, poor gait, lower limb muscle weakness, slowed reaction time have been identified as independent risk

factors for falls in elderly (30, 42, 65). There are the reductions and limitations in skeletal muscle function associated with the normal aging process (2). It has been demonstrated that aging is related to poor balance, incorrect gait and weakness in strength and endurance of the muscles (24, 71). Improving lower-extremity muscle force and flexibility, along with aerobic fitness and upright balance, are expected to result in an improvement in gait speed (41). One aspect of walking that changes with age is gait speed (41). After the seventh decade of life, habitual gait speed declines at a rate of 12% to 16% per decade and about 20% per decade for fast gait speed (33). Oberg et al and Bohannon reported that habitual gait speed may decrease by 9% to 11% and fast gait speed may decrease by 8% to 18% between the fourth and eighth decades (7, 48). A decrease in gait speed of 0.1 m/s has been associated with a 10% decrease in the ability to perform instrumental activities of daily living (34).

Several investigations have shown that older adults have the capacity to improve their physical function given appropriately targeted exercise (11, 16, 52, 66). Physical activity has been widely indicated as a strategy for promoting health in the elderly as well as for maintaining functional capacity (12). Regular physical activity can help prevent chronic conditions and it is positively linked to health-related quality of life. Unfortunately, many older adults do not engage in leisure time activity, making it important to design and test physical activity interventions for this population (3). Lifelong activity, even at moderate levels, is associated with longer life expectancy, and regular physical activity among older adults reduces the chance of illness, maintains or increases strength, controls weight gain, and reduces the risk of falling (3). Routine physical activity, as an essential component of healthy and successful aging, is a means of maintaining mobility and functional abilities in aging adults (67, 72, 73). Researchers have found that frail older adults have a much greater potential for increased mobility, and physical, psychological and functional improvements than previously thought possible (15, 36, 39, 58).

Exercise has a major role to play in modifying key falls risk factors and preventing falls among older adults. There are, however, many different types of exercise, some of which are likely to result in greater reductions in falls risk than others (29). Studies have shown that muscles strength decreases with increased age (68) and that reduced muscle strength is one of the major risk factors for falling. Exercise interventions aimed at improving muscle strength have been identified as a key strategy for reducing frailty and maintaining function in old age (9, 13, 43). Type of physical activity is important to increase muscle strength to gain older people living independently (29). Significant differences in biomechanical walking patterns are found between healthy older and younger adults (25, 69). Walking, which is an easy and safe form of weight bearing exercise that does not require any special equipment, also improves muscle strength, balance, coordination, proprioception and reaction time; and eventually improving postural balance; exercise might contribute to reduce incidence of falls. Benefits from programs or interventions producing walking improvement include “increased socialization, greater independence in functional areas, improved posture, balance, coordination, cardiac conditioning, and relief from stress” (47). MacRae et al. (1996) conducted a 12-week walking program to determine the effects on walk endurance capacity, physical activity level, mobility, and quality of life in ambulatory nursing home residents who had been identified as having low physical activity levels and low walk endurance capacities and the results showed significant progress (44). Twelve weeks of daily walking at a self-selected walking pace by ambulatory nursing home residents produced significant improvements in walk endurance capacity. No other significant changes were noted in physical activity level, mobility, or quality of life in either group after the intervention. Also, there were no side effects, such as increases in falls or cardiovascular complications, due to the walking intervention. Lengthening the walking program to 22 weeks produced no further significant changes in any outcome measures (44). Walking, as an intervention, is ideal in its simplicity as a means of improving mobility, strength, and endurance, and in its ability to be integrated into daily care routines (22, 63). In summary, the extent of the research-to-date examining the effects of walking programs is equivocal and limited. Previous studies have focused on selective outcome measures and have not examined the effects of a walking program on falls, pain and motor function. Hence, the purpose of this study is to examine the effect of aerobic exercise (walking) on gait speed and strength of lower limb in elderly female.

MATERIALS AND METHODS

Sample and Procedures

The 36 elderly female were the statistical sample of this study. The subjects were recruited from a social club with regular social activities. They were randomly divided into experimental (18 cases) and control (18 cases) groups. Each subject was questioned about them past medical history and present health status. They had no previous history of orthopaedic problems such as a recent injury or surgery that could affect their walking pattern. The subjects received a stipend to cover their travel expenses and time. Prior to the study, procedures and guidelines were

presented orally and in written form. Subjects agreeing to participate signed an institutionally approved consent form.

Measures

Anthropometric characteristics including height and weight were measured and recorded. Measuring of variables was performed before (pre-test) and after (post-test) the protocol. The experimental group participated in aerobic exercise (walking) program for eight weeks, five sessions per week and 45 minutes per session, while the control group did not participate in any aerobic exercises and not to participate a regular exercise program or a sport, during the study. The Control group was also able to do the physical activity. After completion of initial measurements of 30-second chair stand test and 10-meter walk test, experimental group participation in walking program, lasting for 45 min, five a week for eight weeks. Each participant in this group walks once per day (45 min), five days per week. The initial distance walked is initially determined for each individual based on how far the person can ambulate before visibly becoming fatigued or short of breath, reporting pain or requesting to sit down or rest. The distance walked and the intensity of the walking program during the eight week period is gradually increased, as tolerated by the individual. On the day after the end of the walking program, 30-second chair stand test and 10-meter walk test were repeated. Aerobic exercise (walking) were performed by the subjects under the supervision of athletic trainer. Evaluation of lower limb strength was performed by 30-second chair stand test and speed of gait was studied by 10-meter walk test. Prior to the testing, a standardized 5 min warm-up was completed.

30 SECOND CHAIR STAND TEST

The purpose of this test is to examine lower body strength (32). Therefore, in this study Evaluation of lower limb strength was performed by 30-second chair stand test. Equipment was required for this test: timer and straight back with a 44cm seat height, preferably without arms. From the sitting position, the participant stands up completely up so hips and knees are fully extended, then completely back down, so that the bottom fully touches the seat. This is repeated for 30 seconds. Count the number of times the subjects comes to a full standing position in 30 seconds (32).

10 METER WALK TEST

The aim of this test is a measure of gait speed (7, 8, 70). Therefore, in this study Evaluation of speed of gait was performed by 10 meter walk test. Equipment was required for this test: timer, measuring tape and quiet hallway or open space at least 14 m long. Individual walks without assistance 10 meters (32.8 feet) and the time is measured for the intermediate 6 meters (19.7 feet) to allow for acceleration and deceleration. Start timing is when the toes of the leading foot crosses the 2-meter mark and stop timing is when the toes of the leading foot crosses the 8-meter mark (7, 8, 70). Test be performed at preferred walking speed with three trials, then collect three trials and calculate the average of the three trials.

Statistical Analysis

All data were analyzed using SPSS version 19. The data were tested for normal distribution with the Shapiro-Wilk test. The Independent T-test and paired sample T-test was used to compare the differences between the pre and post-test in both groups. Significances was set at the $P<0.05$ level.

RESULTS

Mean and standard deviation values of age, height and weight of two groups are shown in Table 1.

Table 1. Characteristics of subjects (mead and standard deviation)

Group	N	Age(yr)	Height(cm)	Weight(kg)
Experimental	18	66.32±3.3	154.6±4.1	62.6±7.3
Control	18	67.22±4.2	154.9±3.5	61.9±7.9

Table 2 shows for normal distribution with the Shapiro-Wilk test before performed exercise in both groups. The result of analysis indicated that there was no significant difference in both variables in experimental and control groups.

Table 2. The result of analysis for normal distribution with Shapiro-Wilk test

Test	Group	p
30 second chair stand test	Experimental	0.59
	Control	0.57
10 meter walk test	Experimental	0.62
	Control	0.56

** Significance level set to: P≤ 0.05*.

According to these results in table 3, there was a significant difference between 30 second chair stand test data before and after the walking in experimental group while no significant difference was observed in control group.

Table 3.T-test for comparing 30 second chair stand test data of subjects in the pre-test and post-test in two groups

Variable	Group	Pre test	Post test	D.F	T	P
30 second chair stand test	Experimental	8.01±1.30	11.01±0.41	17	7.31	0.71*
	Control	8.21±1.01	8.73±1.68	17	1.59	0.34

** P value set to 0.05.*

Table 4 presents compares of pre and post-test for 10 meter walk test variable in both groups. Significant difference found between pre and post-test in experimental group in 10 meter walk test variable (P < 0/05) and between pre and post-test of subjects in control group there was no significant difference in this variable (P < 0/05).

Table 4.T-test for comparing 10 meter walk test data of subjects in the pre-test and post-test in two groups

Variable	Group	Pre test	Post test	D.F	T	P
10 meter walk test	Experimental	8.23±1.75	6.19±0.85	17	6.72	0.68*
	Control	7.99±1.84	7.64±0.23	17	1.03	0.21

** P value set to 0.05.*

DISCUSSION

The purpose of this study is to examine the effect of walking on gait speed and strength of lower limb in elderly female. In this respect, the results revealed a significant difference between experimental and control groups in 30 second chair stand test and 10 meter walk test. Also, there was a significant difference between pre and post-test of 30 second chair stand test and 10 meter walk test in the experimental group. Conducting aerobic exercise period increased the strength of lower limb and gait speed of subjects in experimental group. The total, there was an improvement in gait speed and lower limb strength in experimental group. The results of the present research are consistent with previous findings indicating an improvement of motor functions in osteopenic women after conducting an aerobic exercises period (10). Human and animal studies have shown that physical activity can increase strength (26, 35). Exercise studies that aimed at improving both strength have reported improvements on pain relief and physical function (19, 23, 51).

In the scientific literature for walking, there is no valid data regarding the length of walking program (10, 57). We carried out eight weeks program and found a significant difference in gait speed and strength of lower limb for elderly female. Therefore we may suggest that this length of the walking program could be sufficient to gain improvements for gait speed and strength of lower limb.

Previous research indicates that regular participation in physical activity has a positive impact on muscle strength (17, 45). Activities of daily living are composed of static and dynamic conditions such as sitting or walking (49, 61, 62). Our study reports a significant increase in strength of lower limb after the aerobic exercise in elderly female. These findings supported previous findings in relevant literature. Levine et al. suggested that the Pilates exercises can be used after arthroplastic surgeries because strength and flexibility is increased by this method (40). Improvement of strength in lower limb as well as the increase of coordination in these muscles has improved gait ability and balance of subjects. Regarding the improvement of lower limb strength after conducting a period of pilates exercises, we can consider the increase in subjects' balance, especially in lower limbs, plays an important role in maintaining and controlling stature and posture (56). In another study in which the effects of Exercise Intervention Designed to Improve Strength and Dynamic Balance Among Community-Dwelling Older Adults were investigated, lower limb strength increased (20). In another study, investigating Pilates Exercise has Positive Long

Term Effects on the Aged-Related Decline in Balance and Strength in Older, Community Dwelling Men and Women, a significant increase was found in strength and balance in older ambulatory adults (5). Lester et al. suggested that strengthening and aerobic exercise sessions could improve strength in elderly male especially strength. Therefore, it seems that this type of training May reduce the risk of falling in elderly females (57). In another study investigating of the effects of exercise for elderly male to reduce falls, in the study were observed there was an improvement in dynamic balance and muscle strength in experimental group (37). In another study, investigating Pilates Exercises Influence on the Serotonin Hormone, Some Physical Variables and the Depression Degree in Battered Women, it was extracted that Pilates exercise have a positive impact on improvement in muscle strength (1). The consistent results of our study with previous studies (37,55) which indicated that various exercise programs and aerobic exercises can improve the muscle strength and balance in age groups.

One goal of the present study was the effect of the aerobic exercises on gait speed in older male, the results of this study revealed that a significant increase in gait speed after the aerobic exercise in elderly female, which supported previous findings (46, 59) in the relevant literature. The consistent results of this study with previous studies (4, 60, 61) which indicated that various exercise programs can improve walking speed in patients with multiple sclerosis. The results of the present research are consistent with previous findings (9, 28) indicating an improvement of some physical fitness factors in elderly adults after conducting a training period. Sadeghi et al. suggested that strengthening training sessions could improve gait speed in elderly female (54), which these findings are similar to the findings of the present research. In another study investigating of The Effect of Pilates Exercises and Aquatic Training on Walking Speed in Women with Multiple Sclerosis, in the study were observed there was an improvement in gait speed in Pilates Exercises and Aquatic Training groups (59). In another study in which Effect of exercise on walking speed, fatigue and quality of life of patients with multiple sclerosis were investigated, gait speed increased in patients with multiple sclerosis (4).

The main aim of the study was to investigate whether individuals improved because of the aerobic exercises, which the results of the present research indicated was an improvement in gait speed and lower limb strength in experimental group.

CONCLUSION

Considering the results of present study and the fact that independence of elderly adults is affected by the ability to maintain balance and to walk, we can say that conducting a period of aerobic exercises improves life independence of geriatric population and will ultimately result in their more contribution in the society. Our findings suggest that aerobic exercise may be a useful tool for dynamic balance and gait in elderly. Therefore, we can recommend aerobic exercises to be included in designing training programs for this group of society.

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REFERENCES

[1] Abdel-Hamid Hassan, E and Ahmed Amin, M., **2011**. *World Journal of Sport Sciences*, 5 (2): 89-100.
[2] Anthony, A., Vandervoort, K.C andBlanger, H.A, **2009**. *Physiotherapy Canada*. 10.3138/ptc.38.3.167.pp: 167-73.
[3] Antikainen, I.E., **2011**. Investigating the Effectiveness of Physical Activity Interventions for Older Adults. Kinesiology Dissertations, P: 9.
[4] Asadizaker, M., Majidinasab, N., AtaPour, M., Latifi, S.M and Babadi, M., **2010**. *Medical Journal Jundishapur*, 9(65): 189-98.
[5] Bird, M.L and Fell, J., **2013**. *Journal of Aging and Physical Activity*.
[6] Bize, R., Johnson, A.J and Ronald, C., **2007**. *J Preventive Medicine*, 45, 401-415.
[7] Bohannon, R.W, **1997**. *Age Ageing*, 26:15–9.
[8] Bohannon, R.W., Andrews, A.W., Thomas, M.W., **1996**. *J Orthop Sports PhysTher*, 24(2):86-90.
[9] Bouchard, C., Blair, S.N and Haskell, W.L., **2007**. Physical Activity and Health, p. 274-278, Human Kinetics, USA.

[10] Bravo, G., Gauthier, P., Roy, P.M., Payette, H., Gaulin, P., Harvey, M., Péloquin, L and Dubois, M.F,**1996**. *J Am GeriatrSoc*, 44(7):756-62.
[11] Buchner, D.M and de Lateur, B.J, **1992**. *Ann Behav Med*, 13:91–8.
[12] Busse, A.L., Gil, G., Santarém, J.M and Filho, W.J, **2009**. *Dementia &Neuropsychologia* September; 3(3):204-208.
[13] Carter, N.D., Khan, K.M., Petit, M.A., Heinonen, C., Waterman, M.G and Donaldson, P.A., **2001**. *Br J Sports Med*, 35, 348–351.
[14] Cesari, M., Kritchevsky, S.B., Penninx, B.W., Nicklas, B.J., Simonsick, E.M and Newman, A.B., **2005**. *J Am GeriatrSoc*, 53(10), 1675-80.
[15] Chin A Paw, M.J., van Poppel**,** M.N.M., Twisk,J.WandMechelen,W.v,**2004**. *BMC Geriatr*, 4 (5).
[16] Cress, M.E., Buchner, D.M., Questad, K.A., Esselman, P.C., deLateur, B.JandSchwartz, R.S, **1999**. *J Gerontol: Med Sci*, 54A:M242–M248.
[17] Daubney, M.E and Culham, E.G., **1999**. *Physical Therapy*, 79, 1177-1185.
[18] Deschenes, M.R., **2004**. *Sports Med*, 34(12):809-24.
[19] Deyle, G.D., Henderson, N.E., Matekel, R.L., Ryder, M.G., Garber, M.B and Allison, S.C, **2000**. *Ann Intern Med*, 132: 173–81.
[20] DiBrezzo, R., Shadden, B.B., Raybon, B.H and Powers, Melissa, **2005**. *Journal of Aging and Physical Activity*, 13, 198-209.
[21] Doherty, T.J., **2003**. *J ApplPhysiol*, 95(4):1717-27.
[22] Erdfelder, E., Faul, F and Buchner, **1996**. *InstrumComput*, 28(1):1.
[23] Ettinger WH J.r., Burns, R., Messier, S.P., Applegate, W., Rejeski, W.J., Morgan, T., Shumaker, S., Berry, M.J., O'Toole, M., Monu, J and Craven, T, **1997**. *JAMA*, 277 (1): 25–31.
[24] Eyigor, S., Karapolat, H and Durmaz, B, **2007**. *Archives of Gerontology and Geriatrics*. 45: 259-71.
[25] Ferrandez, A.M., Pailhous, J and Durup, M, **1990**. *Experimental Aging Research*, 16: 79-89.
[26] Gutin, B and Kasper, M.J, **1992**. *Osteoporosis Int*, 2:55-69.
[27] Heath, G.W., **1994**. *Science & Sports*, 9, 197-200.
[28] Hosseini, S.S., KarimiAsl, A., and Rostamkhany, H., **2012**. *World Applied Sciences Journal*, 16 (4): 479-484.
[29] Irez, G.B., Ozdemir R.A., Evin, R., Irez S.G and Korkusuz, F., **2011**. *Journal of Sports Science and Medicine*, 10, 105-111.
[30] Jenkins, S., Cecins, N., Camarri, B., Williams, C., Thompson, P and Eastwood P., **2009**. *Physiotherapy Theory and Practice*, 25(7):516-22.
[31] Jones, C.J and Rikli, R.E., **2002**. *The Journal on Active Aging*, March-April: 24-30.
[32] Jones, C.J., Rikli, R.E and Beam, W.C., **1999**. *Res Q Exerc Sport*, 70(2):113-9.
[33] Judge, J.O., Ounpuu, S and Davis, RB III, **1996**. *Gait and Balance Disorders*, 12: 659–78.
[34] Judge, J.O., Schechtman, K and Cress, E, **1996**. *J Am GeriatrSoc*, 44:1332–41.
[35] Kannus, P., Haapasalo, H., Sankelo, M., Sievanen, H., Pasanen, M and Heinonen, A., Oja, P and Vuori, I, **1995**. *Ann Intern Med*, 123: 27-31.
[36] Kerse, N., Peri, K., Robinson, E., Wilkinson, T., von Randow, M., Kiata, L., Parsons, J., Latham, N., Parsons, M., Willingale, J., Brown, P and Arroll, B, **2008**. *BMJ*, 337:a1445. doi:10.1136/bmj.a1445.
[37] Khajavi, D., Farrokhi, A., JaberiMoghadam, A.A and Kazemnejad,A, **2013**. *Journal of development and motor learning*, 2(12): 49-65.
[38] Lauretani, F., Russo, C.R., Bandinelli, S., Bartali, B., Cavazzini, C and Di Iorio, A., **2003**. *J ApplPhysiol*, 95(5), 1851-60.
[39] Lazowski, D.A., Ecclestone, N.A., Myers, A.M., Paterson, D.H., Tudor-Locke, C., Fitzgerald, C., Jones, G., Shima, N and Cunningham, D.A, **1999**. *J Gerontol A BiolSci Med Sci*, 54(12):M621.
[40] Levine, B., Kaplanek, B., Scafura, D and Jaffe, W.L., **2007**. *Bulletin of the NYU Hospital for Joint Diseases*, 65(2):120-25.
[41] Lopopolo, R.B., Greco, M., Sullivan, D., Craik, R.L and Mangione, K.K, **2006**. *Physical Therapy*, 86 (4): April.
[42] Lord, S.R., and Sturnieks, D.L., **2005**. *Journal of science and medicine in sport*, 8 (1): 35-42.
[43] Lord, S.R., Clark, R.D., and Webster, I.W., **1991**. *Journal of the American Geriatrics Society*, 39(12): 1194-2000.
[44] MacRae, P.G., Asplund, L.A., Schnelle, J.F., Ouslander, J.G., Abrahamse, A and Morris, C, **1996**. A walking program for nursing home residents: effects on walk endurance, physical activity, mobility, and quality of life, 44(2):175-80.

[45] Maughan, K.K., **2008**. Does balance training improve balance in physically active older adults? Iowa State University. UMI number: 1454678.
[46] Nazakatolhosaini, M., Mokhtari, M and Esfarjani, F., **2012**. *Journal of Research in Rehabilitation Sciences*, 8(3).
[47] Norman, G and Gibbs, J, **1991**. *Journal of Gerontological Nursing*, 17(8): 29-33.
[48] Oberg, T., Karsznia, A and Oberg, K, **1993**. *J Rehabil Res Dev*, 30: 210–23.
[49] Özdemir, N., Subasi, S.S., Gelecek, N and Sari, S., **2009**. *Journal of DokuzEylül University Medical School*, 71 – 9.
[50] Patrícia, A., Garc[I]a., João, M.D., Rosângela D., Dias, C., Santos, P and Camila, C., **2011**. *Brazilian Journal of Physical Therapy*, 15 (1).
[51] Peloquin, L., Bravo, G., Gauthier, P., Lacombe, G and Billiard, J.S, **1999**. *J ClinRheumatol*, 5, 126–36.
[52] Pitetti, K.H, **1993**. *Med Sci Sports Exercise*, 25:421–2.
[53] Rolland, Y., Lauwers-cances, V., Cournot, M., Nourhashémi, F., Reynish, W and Rivière, D., **2003**. *J Am GeriatrSoc*, 51(8), 1120-4.
[54] Sadeghi, H., Taghinejad, F and Rajabi, H, **2008**. *Iranian journal of ageing*, 3(9): 30-6.
[55] Sadeghi, H., Yadegaripour, M. Ghasempour, H and Shojaedin, S, **2013**. *Iranian journal of ageing*, 7(27): 59-66.
[56] Salguero, A.R., Garc´a, O., **2010**. *J Gerontol. And Geriatrics*, 10, 110-116.
[57] Sauvage, L.R., Myklebust, B.M., Crow-Pan, J., Novak, S., Millington, P., Hoffman, M.D., Hartz, A.J and Rudman, D, **1992**. *Am J Phys Med Rehabil*, 71, 333-42.
[58] Schnelle, J.F., MacRae, P.G., Giacobassi, K., MacRae, H.S., Simmons, S.F and Ouslander, J.G., **1996**. *J Am GeriatrSoc*, 44(5):507.
[59] Shanazari, Z., Marandi S.M., ShayeganNejad, V., **2013**. *Journal of Research Development in Nursing & Midwifery*, 11(2).
[60] Smedal, T., Lygren, H., Myhr, K., Moe-Nilssen, R., Gjelsvik, B., Gjelsvik, O and Strand, L., **2006**. Balance and gait improved in patients with MS after physiotherapy based on the Bobath concept, Physiotherapy Research International, 11(2):104-16.
[61] Sosnoff, J., Socie, M., Boes, M., Sandroff, B., Pula, J., Suh, Y., Weiker, M., Balantrapu, S., Morrison, S and Mot, R., **2011**. Mobility, Balance and falls in Persons with Multiple Sclerosis. www.plosone.org, November. 6(11):1-5.
[62] Steffen, T.M., Hacker, T.A and Mollinger, L., **2002**. *PhysTher*, 82(2):128-37.
[63] Teri, L., Logsdon, R.G., Uomoto, J and McCurry, S.M, **1997**. *J Gerontol B PsycholSciSocSci*, 52(4):159.
[64] Tietjen-Smith, T., Smith, S.W., Martin, M., Henry, R., Weeks, S and Bryant, A., **2006**. *PhysOccupTherGeriatr*, 24(4), 63-78.
[65] Tinetti, M.E., Baker, D.I., McAvay, G., Claus, E. B., Garrett, P and Gottschalk, M., **1994**. *The New England Journal of Medicine*, 331(13): 821-827.
[66] Verbrugge, L.M, **1991**. Physical and social disability in adults. In: Hibbard, H.; Nutting, PA.; Grady, ML,editors. Primary care research: theory and methods. Rockwell, MD: Agency for Health Care Policy and Research.
[67] Walker, A., **2002**. *IntSocSecur Rev*, 55(1):121.
[68] Wheeler, E.G., **2002**. Lower extremity muscle force production as an independent risk factor for falls in community dwelling elderly females: a case control study. Master of Science thesis. Virginia Commonwealth University, UMI Number: 1409158.
[69] Winter, D.A., Patla, A.E., Frank, J.S and Walt, S.E, **1990**. *Physical Therapy*, 70: 340-47.
[70] Wolf, S.L., Catlin, P.A., Gage, K., Gurucharri, K., Robertson, R and Stephen, K., **1999**. *PhysTher*, 79(12):1122-33.
[71] Wolfson, L., Judge, J., Whipple, R and Kixy, M, **1995**. *J Gerontol*. 50A: 64-7.
[72] World Health Organization: Health and ageing. A discussion paper. Health and ageing. A discussion paper, **2001**.
[73] World Health Organization: The Heidelberg guidelines for promoting physical activity among older persons, **1997**. *J Aging Phys* Act, 5(1).
[74] Zhong, S., Chen, C.N and Thompson, L.V, **2007**. *Rev Bras Fisioter*, 11(2):91-7.