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Research Article

Correlation of Strength and Change in the Thickness of Back Extensor Muscles during Maximal Isometric Contraction in Healthy and Osteoporotic Postmenopausal Women

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ABSTRACT

Introduction: According to the importance of the back extensor muscle strength in postmenopausal women, this study aimed to determine the relationship between strength and changes in the thickness of back extensor muscles during isometric contraction in healthy and osteoporotic postmenopausal women.

Material and Methods: 42 volunteer postmenopausal women according to their Bone Mineral Density divided into two groups "healthy" and "osteoporosis." Strength and thickness of the muscles were measured, respectively, using a handheld dynamometer and ultrasonography. The interclass correlation was used to evaluate the relative reliability dynamometer and ultrasonography. In addition, the Pearson's correlation coefficient was used to analyze the relationship between the strength and thickness.

Results: The results indicated a high reproducibility dynamometer test and ultrasonography. There was a good significant positive correlation between strength and the thickness change of the muscles during isometric contractions in the healthy group ($P < 0.050$), but in the osteoporosis group, there was no significant relationship between these two variables.

Conclusion: In postmenopausal women with osteoporosis, due to the low quality of muscles (muscular component of strength), changes of the muscle thickness is not in line with muscle strength during isometric contraction, so it is necessary special back muscle training for these subjects besides of other treat intervention from the point of rehabilitation.

Keywords: Back extensor muscles; Strength; Thickness; Osteoporosis

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Introduction

Osteoporosis is a kind of systematic skeleton disease which is known to decrease of osseous compression and mass and demolition of osseous texture understructure (1). The decrease of osseous mass follows by the decrease of muscle strength. Back extensor muscles are the most important muscles, which become weak during osteoporosis disease (2, 3). The investigations have shown that strength of these muscles in woman who has osteoporosis is decreasing (4, 5), this strength deduction caused to the creation of kyphotic posture (6). It is important to say that the strength of muscle, which, touched by the muscle's texture may arise from nervous elements (7). In the event that the nervous system changes leading the deduction of strength, but the level of section and thickness do not change and act with the protection of available structure. In as much as main supporter muscles of back spinal column are erector spine muscles (8) therefore consideration and investigation of the strength of these muscles are very important from the aspect of their effects on posture. On the other hand, the thickness of muscles does not always increase with the increasing of muscle strength, but also the strength of muscle increase by the facilitating of the nervous system or the increasing of muscle

quality or both of them (9). In spite of, is there any relationship between change and strength of back extensor muscle thickness in someone who has osteoporosis? It is a question.

Ultrasound is known as a noninvasive and reliable method for measuring the cross-sectional area and thickness of muscles which can directly consider the muscles for someone who experiment momentarily. Hence, the reliability of usefulness instruments to measure the paravertebral muscle thickness is at a high level (10). At first, the study considers the repetition ability of measure method of thickness and strength, and then compares data of two ultrasound and dynamometer methods between two groups and so fixes the relation between two changeable.

Materials and methods

This study has done on 42 postmenopausal women between 50 and 70 age. There were 17 persons with healthy (non-osteoporotic) group with bone mineral density (BMD) T-score > −1 and, 25 subjects in an osteoporotic group with a BMD T-score < −2.5 according to BMD (11). The inclusion criteria included female sex, age between 50 and 70 years, menopause at least 1 year before the study, and no recorded of regular exercise for at least 1 year. The subjects that had secondary osteoporosis, a history of osteoporotic fracture, the presence of neurogenic or myopathy disorders, diabetes, thyroid disease, orthopedic disorders, the use of drugs known to affect muscle strength (i.e., corticosteroids), any musculoskeletal disease with deformity, rheumatoid diseases, any type malignant neoplasia were excluded from the study. The method used in this study was approved by the Medical Ethics Committee of the University. The methods and the aims of doing assessments have explained completely, and all the persons sign satisfaction form before the start of assessments. All assessments have by a physiotherapist cooperate with a rheumatology specialized physician in the Biomechanics Laboratory of the Physiotherapy Department of Medical Science Faculty in Tarbiat Modares University.

It has used a digital handheld dynamometer to measure the strength of the back extensor muscles (Handheld Dynamometer, Model 01163SC, Lafayette Instrument Company Lafayette, IN 47903, USA). The subjects lie down prone, their lower back fixed by strap to prevention of every additional movement which may effect on evaluations. Then, the dynamometer sets between two scapula and at the same time by applying the resistance in the direction to raising the shoulders and upper body from the bed, dynamometer number was recorded as back extensor muscle strength during isometric contraction in kilograms value. Measurements were repeated 3 times with an interval of 1-minute rest between them, and the highest value was considered as the strength (12).

Ultrasonic devices made in Japan (Honda Electronics HS 2100) with 7.5 MHz linear probe (7 to 10 MHz frequency range) were used for evaluating the back extensor muscle thickness. The accuracy of measuring in recording these muscles thickness was 0.1 mm. The applicator is placed 3 cm out of the middling line along T8 (13). To locate T8, from the C7 spinal process was counting down to for fixing the place of spinal process of T8. Again, the place of setting T8 was confirmed by counting the vertebral spine from T7 since the inferior angle of the scapula is in level of T7. Then, individuals lying prone and the lower extremity from knee and low back was fixed by strap, upper extremity the person was in the trunk. In this situation (rest) were recorded the muscle thickness. Then, without moving the applicator, the subjects were asked to try lifting up shoulder and upper trunk. At that moment, the examiner was applied opposite forces until the subject has set in a state of maximum isometric contraction. The test was repeated three times, and the highest value as the maximum voluntary muscle contraction recorded, and then, the thickness of this effort considers as a "maximum thickness of the maximum voluntary effort" by ultrasonography (Figure 1). The time of keeping each contraction set for 5 seconds.

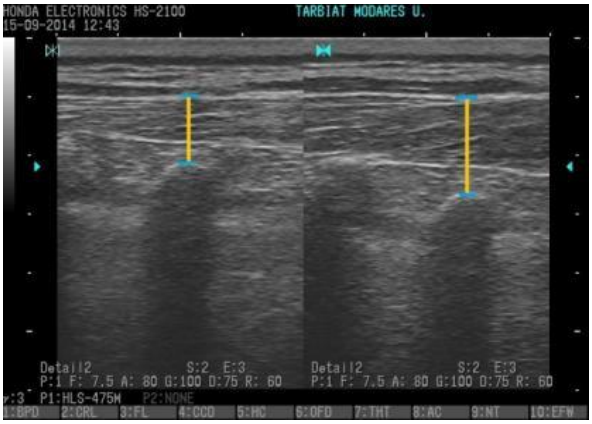

Figure 1. Ultrasonography image of the back extensor muscles at rest (left) and maximum contraction (right)

Reproducibility test

In a methodological study on 12 healthy women aged 50-70 years, ultrasound test repeatability, as well as the strength of the muscles of the back extensor muscles during isometric contractions, were evaluated. Designing and implementation of this test for both sonography and strength was exactly the same as the original test.

For this purpose, strength and thickness measurement was repeated 3 times in a day.

Data analysis

Descriptive statistics was calculated from all data.

Table 1. Clinical characteristics of the healthy and osteoporotic group

Variables	Healthy group (n = 17)	Osteoporotic group (n = 25)	P value
Age (years)	54.88 ± 3.53	57.80 ± 5.26	0.053
Weight (kg)	69.25 ± 7.49	65.04 ± 7.47	0.096
Height (cm)	158.06 ±5.68	155.72 ± 5.35	0.183
BMI (kg/m^2)	28.20 ± 2.94	26.79 ± 2.68	0.116
Time since menopause (years)	5.44 ± 4.47	11.02 ± 6.18	0.003*
T-score	−0.07 ± 0.56	−2.90 ± 0.46	< 0.001*

Data are mean ± SD. SD: Standard deviation; * A significance difference between two groups

The Kolmogorov–Smirnov test was shown normal distribution of data, so was used independent t-test to compare the mean anthropometric variables, strength, and thickness in both groups, also was used interclass correlation coefficient for the repeatability of variable strength and thickness, and correlations between variables strength and thickness were performed by Pearson's coefficient correlation. Statistical significance was set at P < 0.050. SPSS (Version 22; SPSS Inc., Chicago, IL., USA) was used for statistical analysis.

Results

Physical characteristics of the volunteers are shown in table 1 (mean ± SD). There was not any significant difference in age, weight, height, and BMI between two groups. However, the group that has osteoporosis passed a long time from menopause rather than the healthy group meaningfully (P < 0.050). The data related to the repetition shows the high repetition in both methods of strength measurement with intraclass correlation coefficient (ICC) = 0.84 and extensor muscle thickness with ICC = 0.88 (Table 2).

Table 2. Data reproducibility strength and thickness of the back extensor muscles

Back extensor muscles (n = 12)	ICC	P value
Strength (kg)	0.845	0.003*
Thickness (mm)	0.842	0.001*

ICC: Intraclass correlation coefficient

* Means the data is reproducible and reliable

The mean and standard deviation of strength and change the thickness of the back extensor muscles in an isometric contraction are shown in table 3 sorts according to kilogram and millimeter. Independent t-test results between the two groups showed that that the strength in osteoporosis group is lower than the healthy group significantly (P < 0.001). However, there is not any significant difference between two groups in the other variable such as extensor muscle thickness.

The results of Pearson's correlation coefficient test showed that there is a positive significant relation between the thickness change and strength of back extensor muscles during Isometric contraction in the healthy group while there is not any meaningful relation between these variables in osteoporotic group (Table 4 and Figure 2).

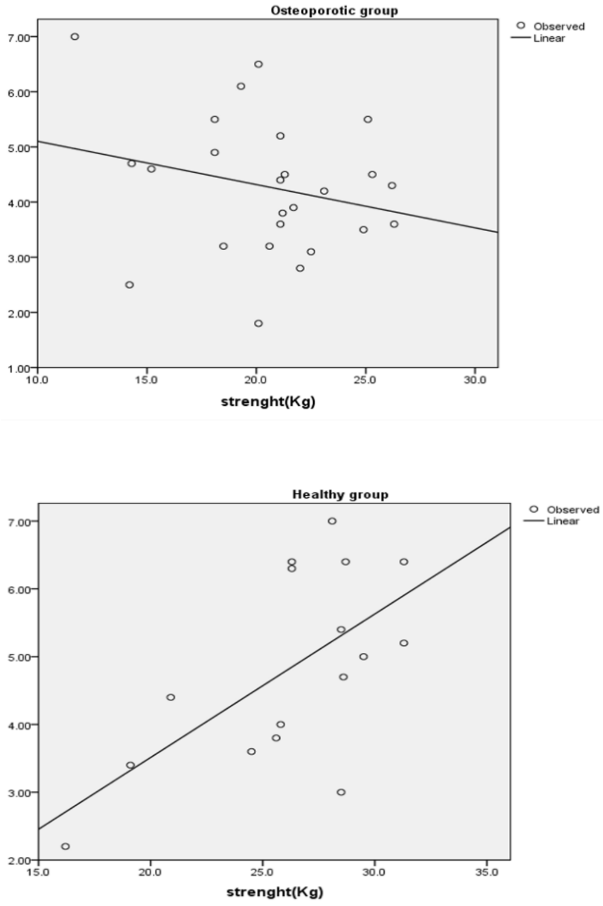

Figure 2. The correlation between strength and change the thickness of the back extensor muscles during isometric contraction in healthy (right) and osteoporosis group (left)

Table 3. Mean of Back extensor muscle strength and thickness in healthy and osteoporotic group

Variable	Healthy group (n = 17)	Osteoporotic group (n = 25)	P value
Strength (kg)	25.98 ± 4.20	20.52 ± 3.80	< 0.001*
Rest thickness (mm)	7.90 ± 1.43	8.95 ± 2.41	0.128
Contraction thickness (mm)	12.72 ± 1.36	13.11 ± 2.34	0.515
Change thickness (mm)	4.82 ± 1.42	4.27 ± 1.24	0.201

Data are mean ± SD. SD: Standard deviation; * A significance difference between two groups

Table 4. The correlation coefficient between strength and change the thickness of the back extensor muscles in isometric contraction

Group	PCC	P value
Healthy (n = 17)	0.631	0.009*
Osteoporosis (n = 25)	−0.239	0.250

*A significant correlation of strength and thickness. PCC: Pearson correlation coefficient

Discussion

This study compared strength and change in the thickness of back extensor muscles during isometric contraction in healthy and osteoporotic postmenopausal women and the relation between these variables. The findings showed that the strength of back extensor muscles in postmenopausal women who have osteoporosis is lower than healthy women, which was homogenous with the results of Sinaki et al. (14) and Granito et al. (15) studies.

The importance of muscular mass and strength for daily activities and exercises is axiomatic (16). The strength and maximum power of muscles, especially back extensor muscles which have affected posture will affect physical operation, and individual's daily life activities (17-19).

Strength deduction of back extensor muscles causes the danger of rising vertebra break (20, 21) and the thoracic kyphosis angle (6). Some studies have shown that the women with more kyphosis, have problems in physical operations such as stand up without hand help, balance on the uneven surface, walking on the ground, and go upstairs (14, 17, 22, 23). These limitations of physical operation cause the rising dangers of falling, break, disability, and death (14, 23-26).

The results showed that change in mentioned muscles thickness during Isometric contraction is lesser than the healthy group in whole the osteoporosis group. However, this difference was statistically meaningless. There is a good significant relation between the extensor muscles thickness and strength in healthy postmenopausal women, but there was not any significant relation in osteoporotic postmenopausal women between these two variables, back extensor muscles thickness consideration has never been studied people with osteoporosis. It can be mention to Morkved et al. (27) study of the relation between the strength and change of thickness in other muscles. They observed positive, powerful relation between the strength and change of thickness in pelvic floor muscles in pregnant women who have urinary incontinence and healthy women (r = 0.703). This is concordant with the attained results on the healthy group in this study. In general, when muscles contract the length of muscle, it will be short, and the bulk of muscle or its cross-sectional area will increase. On the other hand, that's why some parts of muscles strength relate to nervous factor which leads to the increasing of the bulk of muscle and the bulk of muscle is the reflection of thickness and section area (28-31), therefore the presence of direct relation between strength and change of muscle thickness seems logical.

Decline in muscle efficiency, strength, and mass which are called sarcopenia relate to age, it will happen in both sexes. However in women is faster than men and they have sudden falls of sexual hormones that followed by women in the postmenopausal after 50-year-old. Sarcopenia relates to age in women aggravate on the menopausal time (32). In a way that the fast decline of muscles mass and strength in young women in the menopause are reported: 0.6% and 1.17% in the year (33), however, sarcopenia in postmenopausal with normal bone density: 16%; in postmenopausal women who have osteopenia 25% and the postmenopausal women who have osteoporosis 50% are indicated (34). The sarcopenia is not occur in the same for two type fibers, and it involves more fiber Type II. While the loss of muscle mass and strength is not corresponding together so, and muscle strength and power lost more than muscle size and mass (35). Although the decline of muscles mass and power happens in both sexes, this process in women runs faster than in men, because of the sudden fall of sexual hormones in women with menopause. Despite the strong relationship between mass and muscle strength (33), in this process, the strength of muscles decreases more than a mass of muscles (35). Clinical and experimental interventions confirmed that the strength and mass of muscle can be influenced independently (33). Since there is no meaningful difference between individuals sex and age in the related groups of study, so the sarcopenia as a result of age and sex on the decline of muscular mass, was not the object of this difference.

The strength of muscles indicates of the individual's ability to producing force during muscles contraction. The muscle strength, not only related to such muscles elements: numbers and size of muscle fibers (hypertrophy), but also related to such nervous elements: motor neuron requirement, and the nervous firing rate. If the frequency of firing is more, the force in the muscle will increase, which its appearance is obvious in recording of muscles electric activities from the electromyography system (9).

Due to the attention that the nervous part of strength relates to muscle activity, the investigations have shown a close relation of muscle thickness with muscle activities. Therefore, it seems logical part of the strength, which relates to the nervous system has shown a good relation while that part of the strength which relates to the muscle quality and has measured by dynamometer may show no good relation. Walsh et al. (34) have shown that muscles atrophy and the loss of muscular mass is inevitable in the individuals with osteoporosis. On the other hand, Di Monaco et al. (36) and Sjoblom et al. (37) emphasis on the power relation between the decrease of muscle quality (sarcopenia)

and osteoporosis. Indeed, the change of muscle thickness is an indicator of muscular strength in the women in the menopause without osteoporosis, and the muscles thickness change and strength are not equal in someone who has osteoporosis. It is important because, in postmenopausal women, the decline of bone mass not only decreases bone tissue but also the quality of muscle tissue, and this is very important in clinical point of view and necessitates to prescribe the rehabilitation programs.

The study uses a handheld dynamometer for measure strength, which limited in the assessment of muscle strength in the extent of nervous factors. It seems that the synchronous use of electromyography system with dynamometer can entail two factors of strength: nervous and muscular factors in someone who has osteoporosis in contrast to healthy ones should measure to have comprehensive information. Also in this study, the strength has measured in the static condition, it is going to offer that, strength of these peoples in contrast to healthy people without osteoporosis in dynamic activities, or doing functional tasks should be considered.

Conclusion

According to the results of this study, only postmenopausal women without osteoporosis, there was a significant positive relationship between strength and change thickness of the back extensor muscles, that is, by increased the strength, the back extensor muscle thickness increased. However, in postmenopausal women with osteoporosis who had lower average muscle strength, this relationship was not observed. It seems the decrease of strength in people with osteoporosis, occurred more through changes in muscle structure such as reducing the number and size of muscle fibers than changes in the nervous system part. Hence, providing rehabilitation protocols in postmenopausal women with osteoporosis for the strengthening muscles, especially back extensor muscles in addition to reinforcing the nervous part through therapeutic exercise, is important.

Conflict of Interests

Authors have no conflict of interests.

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REFERENCES

1. Sanchez-Riera L, Wilson N, Kamalaraj N, Nolla JM, Kok C, Li Y, et al. Osteoporosis and fragility fractures. Best Pract Res Clin Rheumatol 2010; 24(6): 793-810.
2. Chow RK, Harrison JE. Relationship of kyphosis to physical fitness and bone mass on post-menopausal women. Am J Phys Med 1987; 66(5): 219-27.
3. Itoi E, Sinaki M. Effect of back-strengthening exercise on posture in healthy women 49 to 65 years of age. Mayo Clin Proc 1994; 69(11): 1054-9.
4. Cunha-Henriques S, Costa-Paiva L, Pinto-Neto AM, Fonsechi-Carvesan G, Nanni L, Morais SS. Postmenopausal women with osteoporosis and musculoskeletal status: a comparative cross-sectional study. J Clin Med Res 2011; 3(4): 168-76.
5. Sinaki M, Khosla S, Limburg PJ, Rogers JW, Murtaugh PA. Muscle strength in osteoporotic versus normal women. Osteoporos Int 1993; 3(1): 8-12.
6. Mika A, Unnithan VB, Mika P. Differences in thoracic kyphosis and in back muscle strength in women with bone loss due to osteoporosis. Spine (Phila Pa 1976) 2005; 30(2): 241-6.
7. Aagaard P, Suetta C, Caserotti P, Magnusson SP, Kjaer M. Role of the nervous system in sarcopenia and muscle atrophy with aging: strength training as a countermeasure. Scand J Med Sci Sports 2010; 20(1): 49-64.
8. Sinaki M, Itoi E, Rogers JW, Bergstralh EJ, Wahner HW. Correlation of back extensor strength with thoracic kyphosis and lumbar lordosis in estrogen-deficient women. Am J Phys Med Rehabil 1996; 75(5): 370-4.
9. Lieber RL. Skeletal muscle structure, function, and plasticity. Philadelphia, PA: Lippincott Williams & Wilkins; 2002. p. 277-89.
10. Watanabe K, Miyamoto K, Masuda T, Shimizu K. Use of ultrasonography to evaluate thickness of the erector spinae muscle in maximum flexion and extension of the lumbar spine. Spine (Phila Pa 1976) 2004; 29(13): 1472-7.
11. Osteoporosis prevention, diagnosis, and therapy. JAMA 2001; 285(6): 785-95.
12. Darbani M, Torkaman G, Movassaghe S, Bayat N. Comparison of the hip, ankle and back extensor muscle strength and its correlation with functional balance in healthy and osteoporotic postmenopausal women. J Mod Rehabil 2015; 9(1): 40-52. [In Persian].
13. Miyakoshi N, Hongo M, Maekawa S, Ishikawa Y, Shimada Y, Okada K, et al. Factors related to spinal mobility in patients with postmenopausal osteoporosis. Osteoporos Int 2005; 16(12): 1871-4.
14. Sinaki M, Brey RH, Hughes CA, Larson DR, Kaufman KR. Balance disorder and increased risk of falls in osteoporosis and kyphosis: significance of kyphotic posture and muscle strength. Osteoporos Int 2005; 16(8): 1004-10.

15. Granito RN, Aveiro MC, Renno AC, Oishi J, Driusso P. Comparison of thoracic kyphosis degree, trunk muscle strength and joint position sense among healthy and osteoporotic elderly women: a cross-sectional preliminary study. Arch Gerontol Geriatr 2012; 54(2): e199-e202.
16. Wolfe RR. The underappreciated role of muscle in health and disease. Am J Clin Nutr 2006; 84(3): 475-82.
17. Balzini L, Vannucchi L, Benvenuti F, Benucci M, Monni M, Cappozzo A, et al. Clinical characteristics of flexed posture in elderly women. J Am Geriatr Soc 2003; 51(10): 1419-26.
18. Ryan SD, Fried LP. The impact of kyphosis on daily functioning. J Am Geriatr Soc 1997; 45(12): 1479-86.
19. Takahashi T, Ishida K, Hirose D, Nagano Y, Okumiya K, Nishinaga M, et al. Trunk deformity is associated with a reduction in outdoor activities of daily living and life satisfaction in community-dwelling older people. Osteoporos Int 2005; 16(3): 273-9.
20. Sinaki M, Wollan PC, Scott RW, Gelczer RK. Can strong back extensors prevent vertebral fractures in women with osteoporosis? Mayo Clin Proc 1996; 71(10): 951-6.
21. Sinaki M, Itoi E, Wahner HW, Wollan P, Gelzcer R, Mullan BP, et al. Stronger back muscles reduce the incidence of vertebral fractures: a prospective 10 year follow-up of postmenopausal women. Bone 2002; 30(6): 836-41.
22. Kado DM, Huang MH, Barrett-Connor E, Greendale GA. Hyperkyphotic posture and poor physical functional ability in older community-dwelling men and women: the Rancho Bernardo study. J Gerontol A Biol Sci Med Sci 2005; 60(5): 633-7.
23. Huang MH, Barrett-Connor E, Greendale GA, Kado DM. Hyperkyphotic posture and risk of future osteoporotic fractures: the Rancho Bernardo study. J Bone Miner Res 2006; 21(3): 419-23.
24. Katzman WB, Vittinghoff E, Kado DM. Age-related hyperkyphosis, independent of spinal osteoporosis, is associated with impaired mobility in older community-dwelling women. Osteoporos Int 2011; 22(1): 85-90.
25. Kado DM, Browner WS, Palermo L, Nevitt MC, Genant HK, Cummings SR. Vertebral fractures and mortality in older women: a prospective study. Study of Osteoporotic Fractures Research Group. Arch Intern Med 1999; 159(11): 1215-20.
26. Kado DM, Huang MH, Nguyen CB, Barrett-Connor E, Greendale GA. Hyperkyphotic posture and risk of injurious falls in older persons: the Rancho Bernardo Study. J Gerontol A Biol Sci Med Sci 2007; 62(6): 652-7.
27. Morkved S, Salvesen KA, Bo K, Eik-Nes S. Pelvic floor muscle strength and thickness in continent and incontinent nulliparous pregnant women. Int Urogynecol J Pelvic Floor Dysfunct 2004; 15(6): 384-9.
28. Akima H, Kano Y, Enomoto Y, Ishizu M, Okada M, Oishi Y, et al. Muscle function in 164 men and women aged 20--84 yr. Med Sci Sports Exerc 2001; 33(2): 220-6.
29. Freilich RJ, Kirsner RL, Byrne E. Isometric strength and thickness relationships in human quadriceps muscle. Neuromuscul Disord 1995; 5(5): 415-22.
30. Fukunaga T, Miyatani M, Tachi M, Kouzaki M, Kawakami Y, Kanehisa H. Muscle volume is a major determinant of joint torque in humans. Acta Physiol Scand 2001; 172(4): 249-55.
31. Maughan RJ, Watson JS, Weir J. Relationships between muscle strength and muscle cross-sectional area in male sprinters and endurance runners. Eur J Appl Physiol Occup Physiol 1983; 50(3): 309-18.
32. Lowe DA, Baltgalvis KA, Greising SM. Mechanisms behind estrogen's beneficial effect on muscle strength in females. Exerc Sport Sci Rev 2010; 38(2): 61-7.
33. Rolland YM, Perry HM 3rd, Patrick P, Banks WA, Morley JE. Loss of appendicular muscle mass and loss of muscle strength in young postmenopausal women. J Gerontol A Biol Sci Med Sci 2007; 62(3): 330-5.
34. Walsh MC, Hunter GR, Livingstone MB. Sarcopenia in premenopausal and postmenopausal women with osteopenia, osteoporosis and normal bone mineral density. Osteoporos Int 2006; 17(1): 61-7.
35. Narici MV, Maffulli N. Sarcopenia: characteristics, mechanisms and functional significance. Br Med Bull 2010; 95: 139-59.
36. Di Monaco M, Vallero F, Di Monaco R, Tappero R. Prevalence of sarcopenia and its association with osteoporosis in 313 older women following a hip fracture. Arch Gerontol Geriatr 2011; 52(1): 71-4.
37. Sjoblom S, Suuronen J, Rikkonen T, Honkanen R, Kroger H, Sirola J. Relationship between postmenopausal osteoporosis and the components of clinical sarcopenia. Maturitas 2013; 75(2): 175-80.