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Effect of stair climbing and sand dune running on selected strength variables of school boys

Dr. Sudhakara Babu Mande

University College of Physical Education & Sports Sciences Acharya Nagarjuna University .Guntur, Andhra Predesh. India.

Abstract
The purpose of this study was to find out the Effect of stair climbing and sand dune running oselected strength variables (Leg Strength, Back Strength) of school boys. The primary responsibility of the investigator is to adopt the appropriate experimental methodology before proceeding with data collection. A pretest-posttest randomized group design was used. Randomly selected schools boys (N=45) were divided into three groups. Each group consisted of fifteen school boys (n=15). Before the training pre test was taken for all the groups on the selected criterion variables, strength variables, variables. The control group did not undergo any type of training. Stair climbing training was given to the experimental group I and sand dune running was given to the experimental group II on alternate days in the morning for a period of twelve weeks. At the end of experimental period the post test was conducted on all subjects and data collected on criterion variables. The difference between the initial and final means of the groups was considered as the effect of respective treatments. The data obtained were subjected to statistical treatment using ANCOVA. In all cases, 0.05 level was fixed to test the hypothesis of this study.

Keywords: Stair Climbing, Sand dune running, Strength variables, Leg Strength, Back Strength.

Introduction
The ancient philosopher Aristotle of Greece proclaimed the quality of people, quoted by Bucher as follows: "The body is the temple of the soul and to reach harmony of body, mind and spirit, the body must be physically fit". The efficiency of the human body depends upon many factors. With the enhanced status of sports in society the provision of sports training has become very important although the need for competent training has long been recognized

Stairclimbing training
Training programme which have been used to improve sprinting speed include weight training, wind sprint stairs sprinting. Such programmes are designed to develop leg strength, leg speed, speed endurance and explosive power. (Mac Miller, 1974) [1]. Staircase training is a suitable exercise to burn fat and improve the condition of heart and lungs. Staircase training is a creative, fund and very challenging patterns of movement, that is, on and off stair case can challenge the legs, foot steps and arms also. Correct staircase or stepping technique also prevent injuries and improves performance. Robinson (1971) has provided guidelines for staircase training as stated below. Always place your entire foot on the platform no part of the foot should hand over the edge. Step close to the platform allowing the heels to contract the floor. Note only the ball of the foot not the heel should touch the floor during lunges or other rapidly repeated movements. Step quickly – pounding can unduly stress ankles and knees. Keep an eye on the platform at all times. Don't use hard weights. They greatly increase the risk of injury and provide no benefit.

Benefits of stair climbing
The benefits of stair climbing are detailed below: Stair climbing burns about twice as many calories than any other sport or activity. Stair climbing is an excellent way of losing body fat and toning up thigh muscles. It firms up legs, stomach and butt. Stair climbing improves bone density and studies have also proved that good cholesterol levels rise if it is incorporated in daily exercise regimen Because it is a grueling sport, stair climbing requires less time to do the same intensity of a workout. For example, if one run 30 minutes per day, the same workout intensity could be achieved with 15 minutes of stair climbing. Stair climbing is a total body workout. It makes the arms stronger with the use of the arms pulling you up with the use of the rails (or banister) which is allowed and encouraged. Stair climbing especially builds muscle mass in the legs, including the quadriceps and calfs. It is an aerobic sport as it works the cardio-vascular lung package. Stair climbing becomes an anaerobic event after about 10 to 20 flights of stairs as it strains your aerobic capacity to hold an intense load on the cardio-vascular package to the top of a very tall building. Since the contest is vertical, even a 70 story race up is not a total sprint and requires endurance, sprint, and muscular strength to complete in a fast time. Stair climbing is excellent for cross-training. Runners, swimmers, cyclists, rowers, soccer (or football), and others find stair climbing to be helpful with its total workout. Cyclists, skiers, and rowers are especially attracted to the muscle mass in the legs which can be developed with stair climbing. Stair climbing does not require the purchase of any expensive equipment. It can be done almost anywhere. One could practice stair climbing at any public place that has many flights of steps, including, but not limited to: your apartment building, condominium building, the house stairs, the stairs leading to a public building, the library, or at a gym.

Sand dune running
In physical geography, a dune is a hill of sand built by aeolian processes. Dunes occur in different forms and sizes, formed by interaction with the wind. Most kinds of dunes are longer on the windward side where the sand is pushed up the dune and

have a shorter "slip face" in the lee of the wind. The valley or trough between dunes is called a slack. A "dune field" is an area covered by extensive sand dunes. Large dune fields are known as ergs. Some coastal areas have one or more sets of dunes running parallel to the shoreline directly inland from the beach. In most cases the dunes are important in protecting the land against potential ravages by storm waves from the sea. Although the most widely distributed dunes are those associated with coastal regions, the largest complexes of dunes are found inland in dry regions and associated with ancient lake or sea beds. Dunes also form under the action of water flow (alluvial processes), on sand or gravel beds of rivers, estuaries and the sea-bed.

Benefits of Sand Running

Sand, mud, dirt, grass and trails are excellent training surfaces. They force to run slower for the same heart rate, giving the main benefit of altitude training that is, lower risk of injury as high running intensity is the second best predictor of injury. Half the purpose of 80% of running is to develop a big pump and to maximize the bellows. The heart and lungs don't care if one is swimming, biking, or running at 10 minute miles in 6 inches of mud. However, the running and biking muscles do need some training at 1-2 minutes per mile (for running) slower than race pace, at race pace and also at faster than race pace The trouble with deep sand is that it gets in to the shoes. It can also mess with the running form. But it gives one a tough workout with very low mileage; the back and shoulders get a workout because one has to maintain balance.

Training on sand is so beneficial to every type of martial artist and ten seconds into it and the differences will be noticed from when training on a hard durable floor. When training in dojo, home or wherever it is normally train, it's very easy to take for granted that the floor helps with movement.

Try getting up and jumping from side to side. If one stop to analyze the process of moving, one should notice that in order for this to happen, he has to push into the ground with the feet, so as to drive the legs to start the movement. This pushing into the ground with the feet is also achieved when walking, running, jumping, kicking and lunging. When a grappler moves when ground fighting, not only will he/she use his feet to push, creating movement, but also the hands are used.

Having a hard floor surface makes this movement process a whole lot easier, but on dry sand it becomes harder as the surface is not durable and very soft and to move, one has to dig the feet (or hands) into the sand slightly so as to create the momentum needed to move. Sparring on sand, either striking, grappling or both, becomes an extremely heavy, and hard work out, as the muscles are used more, but it is another out of the many other hundreds of great ways to improve the leg and arm muscles and stamina. Deep sand is for strength or resistance training. It could include bounding for 20 seconds at a time, or repetitions of 1-5 minutes at 2 mile to 15 K intensity depending upon which training phase one is in. Packed sand can also be used for long repetitions at 15K effort, but is more typically used for VO2 maximizing sessions at 5K to 2 mile race pace with 1-3 minute efforts, or however long it takes one to run 400-1,000 meters on the track.

Strength

Muscular strength is the ability of the body to exert force. Strength is important to every event for both men and women. Muscle fibers within the muscles respond when subjected to weight or resistance training. This response makes the muscle more efficient and able to respond better to the central nervous system. Strength may be broken down into three types:

- Maximum strength
- Elastic strength
- Strength endurance

Statement of the problem

The purpose of this study was to find out the effect of stair climbing and sand dune running on selected strength variables (Leg Strength, Back Strength) of school boys.

Methodology

The methodology and procedure adopted. This includes the selection of subjects, selection of variables, experimental treatments, selection of test items, procedure for administering the test items, collection of data and statistical technique employed for analysing the data.

The purpose of the study was to find out the effect of stair climbing and sand dune running on selected strength variables(Leg Strength, Back Strength), of school boys.

Selection of subjects

The subjects taken for the present study were forty five school boys from different schools in Andhra Pradesh, who had represented their schools in interschool competitions. The subjects were selected on a random basis and were allotted to three groups (control, stair climbing and sand dune running) by random assignment. The age of the subjects ranged from 14 to 17 years with mean age of 15.8 years.

The requirements of the experimental procedures, testing as well as exercise schedules were explained to them so as to avoid any ambiguity of the effort required on their part and prior to the administration of the study, the investigator got the individual consent from each subject.

Selection of variables

The research scholar reviewed the various scientific literature pertaining to the stair climbing and sand dune running on selected strength variables, from books, journals, periodicals, magazines and research papers. Taking into consideration of feasibility criteria, availability of instruments and the relevance of the variables of the present study, the following variables were selected.

Dependent variables---strength variables:-1) Leg Strength.**2)** Back Strength

Independent variables:-1) Twelve Weeks Stair climbing exercises. 2.) Twelve Weeks Sand Dune running exercises

Experimental design

The primary responsibility of the investigator is to adopt the appropriate experimental methodology before proceeding with data collection. A pretest-posttest randomized group design was used. Randomly selected schools boys (N=45) were divided into three groups. Each group consisted of fifteen school boys (n=15). Before the training pretest was taken for all the groups on the selected criterion variables, strength variables, leg strength, back strength, variables. The control group did not undergo any type of training. Stair climbing training was given to the experimental group I and sand dune running was given to the experimental group II on alternate

days in the morning for a period of twelve weeks. At the end of experimental period the post test was conducted on all subjects and data collected on criterion variables. The difference between the initial and final means of the groups was considered as the effect of respective treatments. The data obtained were subjected to statistical treatment using ANCOVA. In all cases, 0.05 level was fixed to test the hypothesis of this study.

Test administration:- leg strength

Purpose:-The purpose of the test was to measure the leg strength of the subjects.

Equipments:-Leg dynamometer, paper and pencil

Procedure:-A calibrated leg dynamometer was used to measure the leg strength of the subjects. It was taken on all subjects in the evening after a small warming up session, at a temperature of 30^{o}C. The subjects were asked to stand on the platform of the dynamometer holding the handle of a chain attached with the platform of the dynamometer. The handle was instructed to be placed in front of the thigh and the height of the handle was adjusted with the varying height of the subjects. The elbows were bent and were placed by the side of the body and knees flexed. Subjects were then asked to lift the handle up, by straightening the legs. The subjects were instructed not to pull the hands. Scoring:-The reading on the dial of dynamometer was carefully recorded to the nearest kilogram. Three trials were given to the subjects and the best attempt was recorded as final score.

Back strength

Purpose:-The purpose of the test was to measure the back strength of the subjects.

Equipments:-Back dynamometer, paper and pencil

Procedure:-A calibrated back dynamometer was used to measure the back strength of the subjects. It was taken on all subjects in the evening after a small warming up session, at a temperature of 30 ^{o}C. The subjects were asked to stand upright on the base of the dynamometer with feet shoulder-width apart, arms straight, and fingers extended downward as far as possible on the fronts of thighs. The bar was then attached to the chain so that it is 1 to 2 inches below the fingertips. Then bent forward slightly and grasped the bar. The correct position to lift was with the back bent forward slightly at the hips and keeping their legs straight. Head should be held upright, and the subject should look straight ahead. Lift steadily, keeping legs straight and feet flat on the base of the dynamometer. At the completion of the test, the back should be almost straight. If it is perfectly straight, the test should be repeated with the bar slightly lower. The subjects were instructed not to pull the hands.

Scoring:-The reading on the dial of dynamometer was carefully recorded to the nearest kilogram. Three trials were given to the subjects and the best attempt was recorded as final score.

Statistical procedure

The following statistical tool, i.e., one way Analysis of Covariance ANCOVA was followed to estimate the effect of stair climbing and sand dune running on selected strength and endurance of school boys players as suggested by Thomas and Nelson.(1990)

$$\text{F-ratio} = \frac{(MSy.x)b}{(MSy.x)w.}$$

Where,

(MSy.x) b is the final adjusted mean squares between, and

(MSy.x) w is the final adjusted mean squares within

When significant differences were noted, the Scheffe's post hoc test was used to find out the paired means significance difference.

Results and discussions.

Computation of analysis of covariance and post – hoc test.

Results on leg strength

The statistical analysis comparing the initial and final means of Leg Strength due to Stair climbing Training and Sand dune training among school boys is presented in Table 1.

Table no 1. Computation of analysis of covariance of leg strength

	Stair Climbing Training	Sand Dune Training	Control group	Source of Variance	Sum of squares	df	Mean squares	Obtained f
Pre test mean	94.53	93.13	95.00	Between	28.31	2	14.16	0.36
				Within	1651.47	42	39.32	
Post test Mean	98.73	97.93	96.00	Between	59.24	2	29.62	0.88
				Within	1413.87	42	33.66	
Adjusted Post Test Mean	98.47	98.85	95.35	Between	109.86	2	54.93	9.19*
				Within	245.17	41	5.98	
Mean diff	4.20	4.80	1.00					

Table F-ratio at 0.05 level of confidence for 2 and 42 (df) =3.22, 2 and 41 (df) =3.23 *Significant

As shown in Table I, the obtained pretest means on Leg Strength on Stair climbing Training group was 94.53, Sand dune training group was 93.13 was and control group was 95.00. The obtained pretest F value was 0.36 and the required table F value was 3.22, which proved that there was no significant difference among initial scores of the subjects.

The obtained posttest means on Leg Strength on Stair climbing Training group was 98.73, Sand dune training group Was 97.93 was and control group was 96.00. The obtained posttest F value was 0.88 and the required table F value was 3.22, which proved that there was no significant difference among post test scores of the subjects. Taking into consideration of the pretest means and posttest means adjusted posttest means were determined and analysis of covariance was done and the obtained F value 9.19 was greater than the required value of 3.23 and hence it was accepted that there was significant differences among the treated groups.

Since significant differences were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in

Table 2. Scheffe's Confidence Interval Test Scores on Leg Strength

Means				Required C I
Stair climbing Training Group	Sand dune Training Group	Control Group	Mean Difference	
98.47	98.85		0.38	2.27
98.47		95.35	3.13*	2.27
	98.85	95.35	3.50*	2.27

***** Significant

The post hoc analysis of obtained ordered adjusted means proved that there was significant differences existed between Stair climbing Training group and control group (MD: 3.13). There was significant difference between Sand dune training group and control group (MD: 3.50). There was no significant difference between treatment groups, namely, Stair climbing Training group and Sand dune training group. (MD: 0.38). The ordered adjusted means were presented through bar diagram for better understanding of the results of this study in Fig 1.

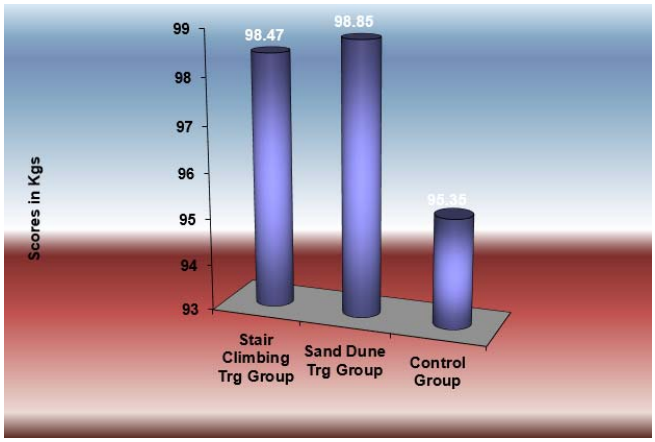

Fig 1: Bar diagram on ordered adjusted means on leg strength

Discussions on findings on leg strength

The effect of Stair climbing Training and Sand dune training on Leg Strength is presented in Table I. The analysis of covariance proved that there was significant difference between the experimental group and control group as the obtained F value 9.19 was greater than the required table F value to be significant at 0.05 level. Since significant F value was obtained, the results were further subjected to post hoc analysis and the results presented in Table II proved that there was significant difference between Stair climbing Training group and control group (MD: 3.13) and Sand dune training group and control group (MD: 3.50). Comparing between the treatments groups, it was found that there was no significant Difference between Stair climbing Training and Sand dune training group among school boys. Thus, it was found that Stair climbing Training and sand dune training were significantly better than control group in improving Leg Strength of the school boys.

Donath L *et al.* (2014) [3]. documented that Stair-climbing serves as a feasible opportunity to remain physically active within everyday-life. Found stair-climbing significantly improved resting and exercise heart rates, perceived exertion, and dynamic balance performance in healthy seniors and may contribute to better overall fitness, reduced fall risk, and less perceived strain during daily life activities. Impellizzeri FM *et al.* (2008) [5]. Compared the effects of plyometric training on sand versus a grass surface on muscle soreness, vertical jump height and sprinting ability. Plyometric training on sand improved both jumping and sprinting ability and induced less muscle soreness. A grass surface seems to be superior in enhancing counter movement jump performance while the sand surface showed a greater improvement in squat jump. Therefore, plyometric training on different surfaces may be associated with different training-induced effects on some neuromuscular factors related to the efficiency of the stretch-shortening cycle.

The findings of this study proved that both stair climbing and sand dune running significantly improved leg strength of the school boys. This may mainly because the explosive-type strength trainings would have altered kinetics and neuromuscular activity during stair ascent and sand dune running. Explosive-type strength training led to enhanced stair-climbing performance at maximal and self-chosen speed, reflecting an improved functional ability Holsgaard-Larsen A *et al.* (2011) [4]. Thus, the findings of this study were in agreement with the findings of Donath L (2014) [3]. Impellizzeri FM *et al.* (2008) [5]. Holsgaard-Larsen A *et al.* (2011) [4].

Results on back strength

The statistical analysis comparing the initial and final means of Back Strength due to Stair climbing Training and Sand dune training among school boys is presented in Table 3.

Table 3. Computation of analysis of covariance of back strength

	Stair Climbing training	Sand Dune training	Control group	Source of variance	Sum of squares	Df	Mean squares	Obtained f
Pretest mean	121.53	121.07	122.00	Between	6.53	2	3.27	0.08
				Within	1822.67	42	43.40	
Posttest mean	125.73	127.40	123.00	Between	148.04	2	74.02	2.06
				Within	1506.53	42	35.87	
Adjusted posttest mean	125.73	127.80	122.60	Between	204.42	2	102.21	22.19*
				Within	188.86	41	4.61	
Mean diff	4.20	6.33	1.00					

Table F-ratio at 0.05 level of confidence for 2 and 42 (df) =3.22, 2 and 41 (df) =3.23.
*Significant

As shown in Table III, the obtained pretest means on Back Strength on Stair climbing Training group was 121.53, Sand dune training group was 121.07 was and control group was 122.00. The obtained pretest F value was 0.08 and the required table F value was 3.22, which proved that there was no significant difference among initial scores of the subjects.

The obtained posttest means on Back Strength on Stair climbing Training group was 125.73, Sand dune training group was 127.40 was and control group was 123.00. The obtained posttest F value was 2.06 and the required table F Value was 3.22, which proved that there was no significant difference among post test scores of the subjects.

Taking into consideration of the pretest means and posttest means adjusted posttest means were determined and analysis of covariance was done and the obtained F value 22.19 was greater than the required value of 3.23 and hence it was accepted that there was significant differences among the treated groups.

Since significant differences were recorded, the results were subjected to post hoc analysis using Scheffe's Confidence Interval test. The results were presented in Table IV**.**

Table 4. Scheffe's Confidence Interval Test Scores on Back Strength

Means				
Stair climbing Training Group	**Sand dune Training Group**	**Control Group**	**Mean Difference**	**Required. C I**
125.73	127.80		2.06*	1.99
125.73		122.60	3.13*	1.99
	127.80	122.60	5.19*	1.99

***** Significant

The post hoc analysis of obtained ordered adjusted means proved that there was significant differences existed between Stair climbing Training group and control group (MD: 3.13). There was significant difference between Sand dune training group and control group (MD: 5.19). There was significant difference between treatment groups, namely, Stair climbing Training group and Sand dune training group. (MD: 2.06).

The ordered adjusted means were presented through bar diagram for better understanding of the results of this study in Fig 2.

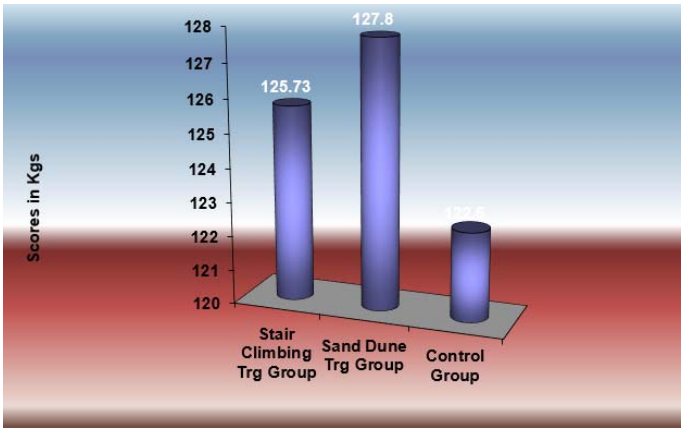

Fig 2: Bar diagram on ordered adjusted means on back strength

Discussions on findings on back strength

The effect of Stair climbing Training and Sand dune training on Back Strength is presented in Table III. The analysis of covariance proved that there was significant difference between the experimental group and control group as the obtained F value 22.19 was greater than the required table F value to be significant at 0.05 level. Since significant F value was obtained, the results were further subjected to post hoc analysis and the results presented in Table IV proved that there was significant difference between Stair climbing Training group and control group (MD: 3.13) and Sand dune training group and control group (MD: 5.19). Comparing between the treatment groups, it was found that there was significant difference between Stair climbing Training and Sand dune training group among school boys. Thus, it was found that sand Training was significantly better than Strair claiming and control group in improving Back Strength of the school boys. Mair JL *et al.* (2014) [6]. Investigated the benefits of a low-volume, vigorous intensity bench stepping programme on cardiorespiratory fitness, body composition and lower limb muscle strength. Due to its low-cost, time-efficient and discrete aspects, stepping exercise may have important implications for public health initiatives that promote physical activity. Donath L *et al.* (2014) [3]. Documented that Stair-climbing serves as a feasible opportunity to remain physically active within everyday-life. Found stair-climbing significantly improved resting and exercise heart rates, perceived exertion, and dynamic balance performance in healthy seniors and may contribute to better overall fitness, reduced fall risk, and less perceived strain during daily life activities.

The findings of this study proved that both stair climbing and sand dune running significantly improved back strength of the school boys and comparing to the treatment groups sand dune training was significantly better than stair climbing. This may mainly because the energy expenditure of jumping on sand and on a firm surface. The differences in the two counter values were both statistically significant. The energy expenditure of jumping in the sand condition was greater than stair climbing Muramatsu S, *et al.* (2006) [6]. And explosive-type strength trainings would have altered kinetics and neuromuscular activity during stair ascent and sand dune running. Explosive-type strength training led to enhanced stair-climbing performance at maximal and self-chosen speed, reflecting an improved functional ability (Holsgaard-Larsen a *et al.* (2011) [4]. Thus, the findings of this study were in agreement with the findings of Mair JL *et al.* (2014), Donath L (2014) [3], Muramatsu S, *et al.* (2006) [6]. Holsgaard-Larsen A *et al.* (2011) [4].

Discussions on hypothesis

1. Stair climbing Training and Sand dune running would improve selected strength variables, leg strength, back strength and upper body strength of school boys.
2. The results presented in Tables I, and III on leg strength, back strength and upper body strength proved there was significant improvement as the obtained F values were

greater than the required table F value to be significant at 0.05 level. Since significant F values were obtained, the results were further subjected to post hoc test using Scheffe's confidence interval test and paired adjusted means comparisons presented in Tables II and ,IV proved that compared to control group, both stair climbing and sand dune running significantly improved lower body strength, upper body strength and shoulder strength of school boys and the formulated hypothesis that stair climbing Training and Sand dune running would improve selected strength variables, leg strength, back strength and upper body strength of school boys was accepted at 0.05 level.

Conclusions

Both stair climbing and sand dune running significantly improved lower body strength of the school boys compared to control group and there was no significant difference between the treatment groups.

Both stair climbing and sand dune running significantly improved back strength of the school boys compared to control group and sand dune running was found to be significantly better to stair climbing in improving back strength of the school boys.

References

1. Donna Mac Miller. Coaching the Female Athlete, Philadelphia: Lea and Febiger, 1974, 146.
2. Clarance Raobinson F. Modern Techniques of Track and Field Philadelphia: Lea and Febiger, 1974, 5.
3. Donath L. Effects of stair-climbing on balance, gait, strength, resting heart rate, and submaximal endurance in healthy seniors, Scand J Med Sci Sports. 2014; 24(2):93-101.
4. Holsgaard Larsen A. Stair-ascent performance in elderly women: effect of explosive strength training, J Aging Phys Act. 2011; 19(2):117-36.
5. Impellizzeri FM. Effect of plyometric training on sand versus grass on muscle soreness and jumping and sprinting ability in soccer players, Br J Sports Med. 2008; 42(1):42-6.
6. Mair JL. Benefits of a worksite or home-based bench stepping intervention for sedentary middle-aged adults a pilot study, Clin Physiol Funct Imaging, 2014; 34(1):10-7.
7. Muramatsu S. Energy expenditure in maximal jumps on sand, J Physiol Anthropol. 2006; 25(1):59-61.