

Effects of Different Intensities of Warm up on the Balance of Indoor Climbers

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ABSTRACT

The purpose of this research was to study the effects of different intensities of warm up on the balance of indoor climbers. In order to do this, a series of carefully designed experiments were carried out. 13 healthy male rock climbers (age 24.46±4.7 yrs) with Difficulty Grade 5.11b – 5.12d on the Yosemite scale. Protocols of 20 minutes warm up were included: 1. running on treadmill in 10 minutes 2. Stretching (general and specific) in 5 minutes. 3. Warm up on easy routes on climbing wall. The subject completed 4 intensity of warm up in 50%-60%-70%, 80% $\dot{V}O_{2max}$ base on the table of American college of sport medicine. The Biodex Balance System was used to implement dynamic test in Athletic single leg test. Overall (OSI), anteroposterior (API), mediolateral (MLI) stability indices were measured in each day that this System was adjusted on level 3 of platform in 10 seconds. Further analysis includes Repeated Measure. The result indicated that there was significant difference ($p < 0.05$) in right foot API and in left foot in OSI & MLI. But there was no significant difference in right foot in MLI & OSI, and in left foot in API. The decreasing trend of OSI score indicates improvement in balance score, so the line chart also indicates improvement in balance score of subjects during 4 days. These results refer to motor patterns of rock climbing and also refer to the effect of the different intensities of warm up on weak muscles that can be shown there is imbalanced strength muscles of feet because of the lack of standard program of training

KEYWORDS: rock climbing; balance; warm up

INTRODUCTION

The purpose of this research was to find the effect of the intensity of warm up activities on the ability to balance by indoor "rock climbers". Balance can be defined as the position of body relative to the arrangement of the limbs and segments, for a specific activity, or the characteristic that one bears the weight of one's body [1]. When an individual is in erect standing posture the integrity of stance is maintained by shifting body weight in multiple directions relative to corrective contractions of the muscles of lower extremities and trunk. The necessity of those contractions is expressed via the somatosensory, vestibular, and visual systems [2]. Success in athletic and recreational activities depends on both balance and functional movements [3]. Balance is one of physical fitness's factors that are related to skills, so it's important in sport performance [4]. Balance training improved performance of selected sport-related activities and postural control measures [3]. So maintaining balance well associates with higher postural control measures and better sport performance. It is presumed that balance training has most profound effect on the somatosensory and proprioceptive control systems [5, 6, 7, 8]. Furthermore Two of the most important factors in rock climbing are balance and concentration [9]. Balance in rock climbing means to poise on one or both legs such that the hands and arms contribute least to the stability of the body poise [9, 10].

According to Shellock and Prentice [11], the best way to prepare for more strenuous exercise (daily training session or competition) is to perform specific warm-up exercises because they provide a rehearsal of the activity and increase body temperature. Warm up in keeping with a scientific program can improve this ability in a person [12]. Based on Kristin Dawn Cadogan, a 10-minute warm-up may decrease postural sway [13]. Research findings in 2004 by James Yaggie shows that muscular fatigue of the lower limbs; has significant effect on the person's balance [1].

Very little research has assessed the effect of warm-up on postural control. The only related literature found pertained to rigorous activity and sensory processes. This type of activity increases the rate of reaction to perturbations of muscle length [14]. Also; an increase in core temperature caused by activity influences the velocity

of muscle shortening [15]. Intense activity increases the rate of reaction to perturbations of muscle length and influences kinesthetic sensation.

This therefore raises the question; “What should be the intensity of a warm up program in order to improve muscular performance without inducing the undesirable effects of muscular fatigue? Therefore, the main reason for a well chosen warm up program with the right intensity is to reach a correct neuromuscular coordination in order to achieve the right balance. Further investigation also shows that no previous work has been done in this field. Hence, this makes it necessary to conduct such research in order to improve the rock climbing skills in the country.

METHODS

Participants

The sample considered for this research were, 13 young, experienced male indoor rock climbers from Mashhad City, in east Iran. The participants had an average age ranging from 19 to 29, with a mean age of 24.46 yrs. and variance of ± 4.7 yrs., and a Difficulty Grade of 5.11b to 5.12d Yosemite Decimal System (YDS)¹, according to their training manager.

Procedures

A 4 days program was designed and used on the subjects. The warm up program lasted 20 minutes in each day; in accordance with Australian warm up protocols [16], using 50%, 60%, 70%, and 80% vo_2 max in each day respectively that target heart rate was calculated by percentage of maximum heart rate ($\%HR_{max}$) and the table of American college of sport medicine(1995) [17]. The warm up program consisted of: (i) running on treadmill for 10 min., (ii) doing general and specific stretching exercises for 5 minutes, and (iii) rock climbing on a simple indoor route for 5 minutes.

“portable polar” equipments were used to measure each subject’s heart beat rate and vo_2 max, immediately followed by; measuring their balance level using “one leg stand test”, through “Biodex (model 950 – 320) balance dynamic test system”, for each leg respectively. Therefore, the participants’ overall stability index (OSI), anterior - posterior index (API), and medial - lateral stability scale index (MLI), were measured on level 3 platform for 10 seconds, everyday. Also, the subjects did not know how to work with the balancing test equipments, therefore in order to reduce the error related to this factor; a day was spent learning to work with these equipments.

Statistical analysis

To Statistical analysis, repeated measurement statistical technique and SPSS 11.5 computer statistical package were used.

RESULTS

The result of this investigation indicates that there is a significant difference ($p < 0.05$), between the API measurements of the right foot of the subjects (Figure 1), while, between MLI and OSI of the right foot seems to be no significant difference ($p > 0.05$).

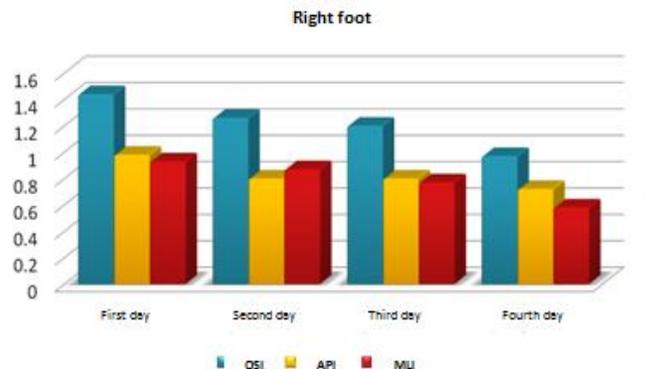


Fig. 1: Mean values of OSI, API, and measurements in 4 days experiment of right feet

¹ Yosemite is a decimal grading scale used to measure the climber’s ability.the most common system used to rate difficulty in the U.S. Most technical rock climbing is rated on a scale of 5.0 to 5.14c/d with higher numbers representing harder climbs

Figure 2 shows that, there seems to be a significant difference ($p < 0.05$) between MLI and OSI measurements of the left foot of the participants. However, there is seemingly not a significant difference ($p > 0.05$) in their API measurements for the left foot.

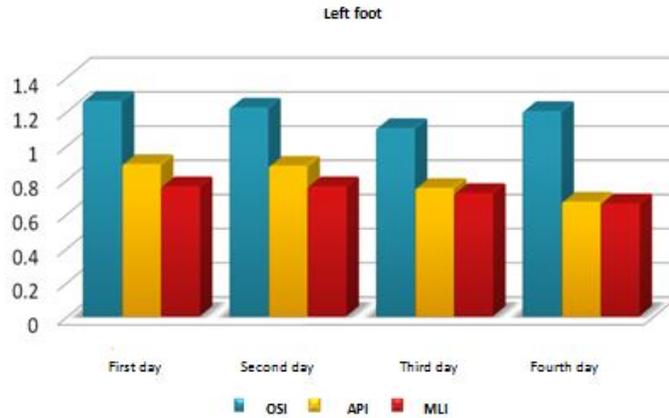


Fig.2: Mean values of OSI, API, and MLI measurements in 4 days experiment of left feet

Also, according to the findings of the investigation the reducing trend of the OSI measurements of the subjects as the days past represented a seeming improvement in their balancing abilities, figure 3.



Fig. 3: Mean values of OSI measurements of right feet and left feet in 4 days experiment

Table1.MultivariateTest(repeated measurement) of balance of right leg in four days						
Right leg	First day	Second day	Third day	Fourth day	f-value	sig
OSI	1.26	1.22	1.1	1.2	3.203	0.071
API	0.89	0.88	0.75	0.67	4.901	0.024*
MLI	0.76	0.76	0.72	0.66	0.685	0.0582

Table2.Multivariate Test (repeated measurement) for balance of left leg in four days						
left leg	First day	Second day	Third day	Fourth day	f-value	sig
OSI	1.44	1.26	1.2	0.97	3.733	0.049*
API	0.98	0.8	0.8	0.72	2.107	0.163
MLI	0.93	0.87	0.77	0.58	6.378	0.011*

DISCUSSION

A reduction in OSI value means that the overall balancing capabilities have improved. Therefore, the negative trend of the mean values of OSI measurements, as shown in Fig. 3, of the rock climbers in the 4 day experiments could mean that the increase intensity of the warm up exercise has had a positive effect on the neuromuscular

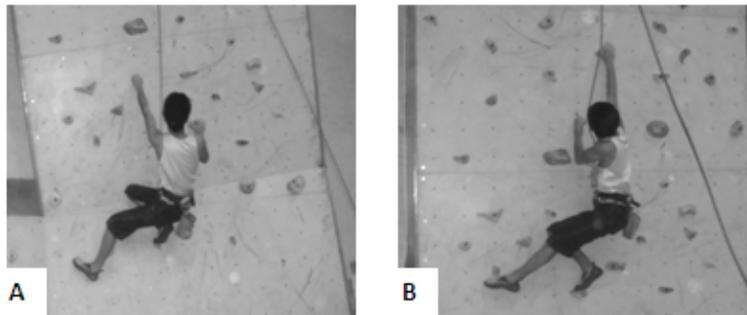
coordination of those parts involved in the subjects' balancing skills. These results support Research finding's Kristin Dawn Cadogan, a 10-minute warm-up may decrease postural sway [13]. However, in order to prove this, more detailed measurements are required including those of API and MLI.

Rapid development of indoor climbing was caused that Difficulty Grade of climber boosted [18] so Artificial climbing structures install on the slope with high negative gradients and over roof to route setting in high grade become easier.

The existence of any significant difference between measurements depends on the movements of climbers. In climbing, the rock climbers use their toes, heels, and the inner and outer side of their feet. The use of outer side of the feet is the most practical technique of climbing in the slopes with negative gradient, roof and overhang [19].

On observing this group was indicated that the right side of the body, i.e. the right hand and foot, was the dominant side so they carry out this technique with right foot to right hand grasp next hold and they can pull up themselves to upper hold. For this purpose, the feet and hands work in opposite way to each other. By this means, that when a move is taken by the outer side of the right foot, then the left hand grabs the hold, while the left toes is balancing on the hold to right hand is grasping next hold as shown in the picture (Pic. 1). So muscles of right foot that control medial – lateral balance are more stronger than muscle of left foot and different intensities of warm up do not have much effect on strong muscles, but different intensities of warm up effect more on less strong muscles of left foot. This is, hence observable as a significant difference in MLI of the left leg, ($p < 0.05$). At the same time, there is no significant difference apparent in MLI for the right leg, ($p > 0.05$).

MLI is a subsection of OSI, the result of the OSI also is like as its subsection, MLI, because the P value was shown completely significant and no significant in sequence to left leg and right leg.



Pic1 .A: The start of the movement by outer side of the right foot. B: The end of the movement by outer side of the right foot.

In other hand, one could also state that the reason for the existence of all these differences is lack of scientific and consistent training program, resulting in unbalanced and weak muscular power of the rock climbers' legs.

At the end, can be concluded from this study; if the trainers include in their training program, exercises that strengthens the relevant muscular power of the rock climbers in a balanced way, then may be the differences for OSI, API, and MLI measures will not be significant due to the warm up exercises intensities. This means there will be an appropriate balance in all intensities of warm up exercise so climber's performance will be increase.

This study has not succeeded in determining specific intensity of warm up exercise that effect on the balancing ability of the rock climbers. Consequently, there is a great need for more research in this field, in order to improve the state of this popular sport.

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