International Journal of Medical, Medicine and Health Sciences
ISSN: 2517-9969
Vol:13, No:10, 2019

Comparative Effect of Self-Myofascial Release as a Warm-Up Exercise on Functional Fitness of Young Adults

Gopal Chandra Saha, Sumanta Daw

***Abstract*—**Warm-up is an essential component for optimizing performance in various sports before a physical fitness training session. This study investigated the immediate comparative effect of Self-Myofascial Release through vibration rolling (VR), non-vibration rolling (NVR), and static stretching as a part of a warm-up treatment on the functional fitness of young adults. Functional fitness is a classification of training that prepares the body for real-life movements and activities. For the present study 20male physical education students were selected as subjects. The age of the subjects was ranged from 20-25 years. The functional fitness variables undertaken in the present study were flexibility, muscle strength, agility, static and dynamic balance of the lower extremity. Each of the three warm-up protocol was administered on consecutive days, i.e. 24 hr time gap and all tests were administered in the morning. The mean and SD were used as descriptive statistics. The significance of statistical differences among the groups was measured by applying 'F'-test, and to find out the exact location of difference, Post Hoc Test (Least Significant Difference) was applied. It was found from the study that only flexibility showed significant difference among three types of warm-up exercise. The observed result depicted that VR has more impact on myofascial release in flexibility in comparison with NVR and stretching as a part of warm-up exercise as 'p' value was less than 0.05. In the present study, within the three means of warm-up exercises, vibration roller showed better mean difference in terms of NVR, and static stretching exercise on functional fitness of young physical education practitioners, although the results were found insignificant in case of muscle strength, agility, static and dynamic balance of the lower extremity. These findings suggest that sports professionals and coaches may take VR into account for designing more efficient and effective pre-performance routine for long term to improve exercise performances. VR has high potential to interpret into an on-field practical application means.

***Keywords*—**Self-myofascial release, functional fitness, foam roller, physical education.

I. Introduction

THE population is aging, and one of the main consequences of this is the progressive decline in functional fitness (FF), including muscular strength, flexibility, balance, agility, gait velocity, and cardiorespiratory fitness [1].

It is reported that the FF is regularly used as a principle indicator of long-term exercise. Thus FF is defined as the physical capacity to carry out normal daily activities. More specifically FF is included with muscle strength, aerobic endurance, flexibility, dynamic balance and agility. Various FF domains can be improved by regular physical activity [2], [3].

Getting old necessarily results in the worsening of bodily tasks (e.g., muscle strength, endurance, aerobic endurance, and flexibility) that impact the execution of various activities in daily life, and the performance of elderly people regarding FF is definitely poorer than that of young people. However, FF also declines or changes as a result of absence of activity. Numerous studies have established that sufficient exercise or bodily activities assist elderly people in sustaining their FF and keeping in fine fettle [4]-[8].

It has been widely accepted that athletes should perform warm-up activities and a stretching protocol prior to, and after participating in, a physically demanding activity [9]-[13]. Various research studies offer different viewpoints regarding the effectiveness of warm-up and stretching protocols in reducing injuries and improving the level of FF [9]-[13].

Warm-up helps to increase the speed and force of the muscle contraction. During this process there are many metabolic sequences take place and it initiates the reduction of internal viscosity which results in smooth muscle contraction. Throughout this process the increment of temperature leads to the dissociation of oxygen from hemoglobin at higher plasma oxygen concentration. It provides more oxygen concentration in the working muscles. Other than this, nerve transmission may also increase the temperature and it raises the contraction speed also simultaneously reduces the reaction time. This type of warm-up exercises helps in vasodilatation and it results in increase blood flow to the active tissue [9]-[13].

Segen's Medical Dictionary defines myofascial release as, "A type of soft tissue therapy used in osteopathy to release physically restricted musculoskeletal groups. It is believed that chronic tension and trauma cause the fascia, which envelops muscle, to become fixed in a particular position, known as a myofascial restriction. Manipulation of the myofascial group is believed to resolve the restriction" [14].

Muscle relaxation can be done through many ways. In early stages hands on massage is very operative technique used as a hand on manual treatment method that applies pressure and stretching to the superficial layer placed on the muscles and also with the intent to increase the mobility of the muscles and the adjoining fascia [15]. Myofascial release is one of the various techniques used to increase mobility in a joint or chains of joints and also increase athletic performance [16]. Execution of myofascial release may be done through scientific manipulation of tissues (massage) or through

Gopal Chandra Saha is with the Jadavpur University, India (e-mail: callmegopal@gmail.com).

apparatuses, typically done by a specialist, but more commonly, self-myofascial release (SMR) is performed. This is by using body weight or force onto an object such as foam roller or lacrosse ball to place pressure along a muscle with the intent to aim the adhesions in fascia to increase mobility [17]. There are different implements that can boost range of motion of joint (ROM) [18] and the recovery process by decreasing the effects of acute muscle soreness, delayed onset muscle soreness (DOMS), [19] and post exercise muscle performance [20]. According to Sefton [21], signs for myofascial release include structural disproportions, acute and chronic pain, muscle spasms, muscle safeguarding, and lack of soft tissue mobility. Trigger points, tight areas in muscle or fascia that cause pain or awkwardness, are also a reason to combine myofascial release.

For both sportsman and energetic individuals, SMR is often used to increase recovery and performance. More recently, myofascial release and SMR have become a more common pre-competition modality to increase performance. Foam rolling has been a common modality in these novel SMR techniques, but there is limited evidence to show that foam rolling is a true myofascial release therapy. Still, most areas of sport medicine are using the terms foam rolling and SMR interchangeably.

It appears that there is potential for the use of foam rolling as a warm-up modality. Although the concept of foam rolling is similar to stretching, myofascial release, and massage, they do not elicit similar results on performance. The mechanisms behind foam rolling are still undetermined, but with the possible utilization of the autogenic and reciprocal reflexes, foam rolling's effect on the body could be similar to a dynamic stretch.

II. Objective of the Study

The objective of the present study was to i) explore the potentiality of foam rolling as a warm-up technique and ii) compare among static warm-up exercises, non-vibrating foam rolling exercise and vibrating foam rolling exercise upon selected FF components.

III. Methodology

20 male physical education students (age: 21.4 ± 1.2 y, height: 1.68 ± 0.6 m) received three trials: (i) static stretching (ii) non vibrating foam roller, and (iii) vibrating foam roller. Exclusion criteria included the presence of cardiovascular or respiratory diseases; contraindications to exercise (e.g., muscle injury or spine injury); any type of sprains and strains; joint immobilization in the bottom half; and visual, vestibular, or sensory organ disabilities during the course of the physical education. The study protocol was approved by the three experts in the field of sports and coaching. Before conducting the study, prior information was shared to the participants for better understanding of the protocols. A prescribed written consent was collected from the participants.

The significance of statistical differences among three different warm-up protocol on selected FF variables of physical education students were measured by applying 'F'-test, and to find out the exact location of difference, Post Hoc Test (Least Significant Difference) was applied. The FF `variables undertaken were flexibility measured by Sit and Reach test and was recorded in cm, muscle strength was measured by vertical jump test and was recorded in cm, static balance was measured by Stork Balance test and was recorded in seconds, dynamic balance was measured by Y Balance test and was recorded in percentage and agility was measured by zigzag run test and was recorded in seconds.

Each module of warm-up protocol was applied 24-hour time gap. After applying those warm-up protocols each of the selected FF was assessed with the standard tests. Participants were requested to avoid strenuous activities during three warm-up session i.e. 72hr total time span. At the starting of each warm-up protocol, five minutes of light jogging was initiated. In this study, VR, NVR, and static stretching exercises were executed on quadriceps and hamstrings.

IV. Results & Discussion

The collected data were recorded for statistical analysis in the form of digital score. In order to get the results from the raw scores Mean and Standard Deviation were employed as descriptive statistics and in order to get results and to find exact differences among the three warm-up exercise programme, the Analysis of Variance and Post-hoc test were employed. Finally with help of significance level (0.05 & 0.01) the final conclusions were drawn.

TABLE I
Mean and SD of Muscle Strength (cm) of Three Different Warm-up Exercise Programme on Sports Persons

Particulars	N	Mean (cm.)	SD (±)
Static Stretching	20	48.35	1.98
Non-Vibrating Rolling	20	47.50	1.09
Vibrating Rolling	20	49.90	1.26

Table I showed that the mean score of muscle strength of three different warm-up exercise programme were: Static stretching: 48.35, non-vibrating rolling: 47.50, and vibrating rolling: 49.90, respectively. The SD of muscle strength of three different warm-up exercise programme were static stretching: 1.98, non-vibrating rolling: 1.09 and vibrating rolling: 1.26.

TABLE II
Significance of Statistical Differences of Muscle Strength (cm) of Three Different Warm-up Exercise Programme on Sports Persons

Particulars	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	59.233	2	29.617		
Within Groups	2377.350	57	41.708	.710	.496
Total	2436.583	59			

Table II clearly revealed insignificant difference of muscular strength among three different categories of warm up exercises (static stretching, non-vibrating rolling and vibrating rolling) as p value was greater than 0.05.

Table III showed that the mean score of flexibility of three

different warm-up exercise programme was static stretching: 9.25, non-vibrating rolling: 9.50 and vibrating rolling: 11.95, respectively. The SD of flexibility of three different warm-up exercise programme were static stretching: 2.22, non-vibrating rolling: 2.28 and vibrating rolling: 2.19.

TABLE III
MEAN AND SD OF FLEXIBILITY (CM.) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	N	Mean	SD
Static Stretching	20	9.2500	2.22
Non-Vibrating Rolling	20	9.9500	2.28
Vibrating Rolling	20	11.9500	2.19

TABLE IV
SIGNIFICANCE OF STATISTICAL DIFFERENCES OF FLEXIBILITY (CM.) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	78.533	2	39.267		
Within Groups	385.650	57	6.766	5.804	.005
Total	464.183	59			

Table IV showed significant difference of flexibility among three different categories of warm up exercises (static stretching, non-vibrating rolling and vibrating rolling) as p value was less than 0.05.

TABLE V
SIGNIFICANCE OF STATISTICAL DIFFERENCES OF AGILITY OF THREE DIFFERENT EXERCISE PROGRAMME ON SPORTS PERSON

Particulars		Mean Difference	Std. Error	Sig.
Static Stretching	Non-Vibrating Rolling	-.70000	.82254	.398
	Vibrating Rolling	-2.70000*	.82254	.002
Non-Vibrating Rolling	Static Stretching	.70000	.82254	.398
	Vibrating Rolling	-2.00000*	.82254	.018
Vibrating Rolling	Static Stretching	2.70000*	.82254	.002
	Non-Vibrating Rolling	2.00000*	.82254	.018

It was clear from Table V that effect on agility of vibrating roller has significant effect over static and non-vibrating roller stretching as 'p' value was less than 0.01 & 0.05. But in case of static and non-vibrating roller stretching for the improvement of flexibility, it proves to be insignificant to each other.

TABLE VI
MEAN AND SD OF STATIC BALANCE (SEC.) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	N	Mean (sec.)	SD (±)
Static Stretching	20	9.150	2.58
Non-Vibrating Rolling	20	8.650	2.29
Vibrating Rolling	20	8.600	2.91

Table VI demonstrated that the mean score of static balance of three different warm-up exercise programme were static stretching: 9.15, non-vibrating rolling: 8.65 and vibrating rolling: 8.600 respectively. The SD of static balance of three different warm-up exercise programme were static stretching: 2.58, non-vibrating rolling: 2.29 and vibrating rolling: 2.9.

TABLE VII
SIGNIFICANCE OF STATISTICAL DIFFERENCES OF STATIC BALANCE (SEC.) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3.700	2	1.850		
Within Groups	493.900	57	8.665	0.214	0.808
Total	497.600	59			

Table VII revealed insignificant difference of static balance among three different categories of warm up exercises (static stretching, non-vibrating rolling and vibrating rolling) as p value was greater than 0.05.

TABLE VIII
MEAN AND SD OF DYNAMIC BALANCE (%) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	N	Mean (%)	S D (±)
Static Stretching	20	81.10	3.15
Non-Vibrating Rolling	20	83.00	2.59
Vibrating Rolling	20	82.40	2.11

Table VIII demonstrated that the mean score of dynamic balance of three different warm-up exercise programme were static stretching: 81.10, non-vibrating rolling: 83.00 and vibrating rolling: 82.40 respectively. The SD of dynamic balance of three different warm-up exercise programme were static stretching: 3.15, non-vibrating rolling: 2.59 and vibrating rolling: 2.11.

TABLE IX
SIGNIFICANCE OF STATISTICAL DIFFERENCES OF DYNAMIC BALANCE (%) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	37.733	2	18.867		
Within Groups	2288.600	57	40.151	.470	.627
Total	2326.333	59			

Table IX revealed insignificant difference of dynamic balance among three different categories of warm up exercises (static stretching, non-vibrating rolling and vibrating rolling) as p value was greater than 0.05.

TABLE X
MEAN AND SD OF AGILITY (SEC.) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	N	Mean	SD
Static Stretching	20	23.27	1.55
Non-Vibrating Rolling	20	23.12	1.51
Vibrating Rolling	20	23.74	1.26

Table X demonstrated that the mean score of agility of three different warm-up exercise programme were static stretching: 23.27, non-vibrating rolling: 23.12 and vibrating rolling: 23.74 respectively. The SD of agility of three different warm-up exercise programme were static stretching: 1.55, non-vibrating rolling: 1.51 and vibrating rolling: 1.26.

Table XI revealed insignificant difference of agility among three different categories of warm up exercises (static stretching, non-vibrating rolling and vibrating rolling) as p value was greater than 0.05.

TABLE XI
SIGNIFICANCE OF STATISTICAL DIFFERENCES OF AGILITY (SEC.) OF THREE DIFFERENT WARM-UP EXERCISE PROGRAMME ON SPORTS PERSONS

Particulars	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.164	2	2.082		
Within Groups	119.638	57	2.099	.992	.377
Total	123.802	59			

V. DISCUSSION OF FINDINGS

From the present investigation it can be said that an acute effect of warm-up with the help of foam rolling and vibrating foam roller has been observed. Although the selected variables such as muscle strength, static balance, dynamic balance and agility proved to have similar effect on myofascial release, in case of flexibility it was found that vibrating foam roller has showed better effect than static warm-up exercises and non-vibrating foam roller exercises. This may be due to the fact that vibrating foam roller involved in great deal of deep muscular penetration than that of other two modes of warm-up exercises. This result is supported by [22] which was conducted on hamstring flexibility in asymptomatic individuals. This finding is also consistent with that of a preceding study, in which self-myofascial exercises has positive effect on hamstring flexibility [22], [23]. Overall, our results represented the significant relationship between vibrating rolling exercises on flexibility. It might help to induce knowledge about the use of vibrating roller on warming-up exercises.

VI. CONCLUSIONS

This study has tried to show different aspects of warming-up through vibrating and non-vibrating foam roller. Now a day's foam rollers are playing very vital role towards players' warming up schedule. So from the present study it is very much evident that foam roller exercises can be used as warm-up protocol and vibrating foam roller can play a crucial role for deep myofascial penetration especially in case of hamstring group of muscles. Moreover, an attempt can be made by using both foam roller and vibrating foam roller for SMR for reduction of hamstring pain while maintaining a base level flexibility.

ACKNOWLEDGMENT

A deep sense reverence and gratitude is expressed towards the subjects and the University authority for their utmost helping to conduct the study smoothly. Authors are also thankful and acknowledge the immense help received from the department of Physical Education, Jadavpur University and its Library. Authors are grateful to the research scholars for proving valuable information and suggestions. The authors are also grateful to the authors/editors/publishers and of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

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