

Effects of Battle Rope Training in Individuals with Sedentary Lifestyle

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Abstract:- There is an increase in the sedentary population day by day which can potentially contribute to ill health and evolving forms of exercise like the battle rope training which provides more results in less time can induce interest in the sedentary population. The study was aimed to investigate the effects of battle rope training on the upper extremity endurance, lower extremity endurance and VO₂ max on sedentary lifestyle after four weeks of intervention on a population of an urban city in India.

This Experimental study encompassed thirty participants fulfilling the eligibility criteria; fifteen participants performing battle rope training sessions and fifteen participants in the control group. The outcome measures assessed were Push up test, Wall sit hold times and Vo₂ max.

A statistically significant difference was seen in push up test, wall sit hold times and Vo₂ max in both groups but was more affected in the group performing battle rope training exercise.

The study concludes that battle rope training is effective in improving upper extremity endurance, lower extremity endurance and VO₂ max on sedentary individuals as compared to conventional training.

Keywords:- Battle Rope Training, Push Up Test, VO₂ Max, Sedentary Lifestyle.

I. INTRODUCTION

Sedentary lifestyle is one of the major causes of various lifestyle diseases nowadays. Effects of a sedentary work life or lifestyle can be either direct or indirect. One of the most prominent direct effects of a sedentary lifestyle is an increased BMI leading to obesity. A lack of physical activity is one of the leading causes of preventable death worldwide (Lopez AD, Mathers CD, et al. May 2006)

Battle rope (BR) training has increased its popularity from past few years. Such evolving forms of exercise will incorporate interest in exercise training which targets multiple muscles at the same time.

Battle rope training is a High-intensity training which consists of undulating a rope with the upper body. It provides a vigorous-intensity cardiovascular and metabolic stimulus, as demonstrated by elevated heart rate and energy

expenditure per unit of time. (Fountaine, CJ and Schmidt, 2015)

Ropes create a dual-force dynamic effect, one that uses the force of gravity and the force created by rope waves to amplify and improve all of the human systems physiological response. Battling rope protocols are used for a variety of training goals including increasing strength, power, local muscular endurance, and agility. It's a challenging way to target weight loss and body fat reductions through increased energy expenditure. BR exercises are said to stimulate high levels of energy expenditure as compared to the energy expenditure seen during traditional resistance exercise. Also, increased cardiovascular demand could be helpful for improving maximal aerobic capacity and metabolic health (Ratamess, Nicholas A, et al. 2015)

Battle ropes results in less injuries because there is a constant connection to the two force producers and it can be as explosive or dynamic as the individual is able to produce force, thus creating the opportunity to grow endurance, strength, power, and skill without a ceiling (Aaron Guyett ,2016)

Unlike the relatively static movement of lifting and lowering a barbell, using battle ropes is a dynamic, ever-changing form of movement that has the added benefit of showing you whether you're doing the movements correctly. The ropes can be whipped, slammed, or dragged, but among the most popular are undulating movements that cause the ropes to move in waves. Battle rope workouts work the muscles in your abs, back, and glutes, and you can incorporate movements, such as jumps, lunges, and squats, that work your legs too(Jonathan Ross, May 25, 2015)

Nowadays lack of time for exercise is the biggest constraint which refrains individuals to undergo daily exercise routine. Battle rope training is a newer form of exercise which can be performed relatively in less time and may give the desired outcomes. But there is paucity of data regarding this exercise form. Very few studies has been done in this regard (Fountaine, CJ and Schmidt, 2015)(Ratamess, Nicholas A, et al. 2015)(Aaron Guyett ,2016)(Chen, wei-han, wu, heuy-June, October 2018)(Calatayud, J Martin Calando, Benítez, 2015) and hence the need of this study arises.

II. RESEARCH METHODS

The study was an experimental study, conducted in Pune region in India. After obtaining approval from institutional ethical committee, subjects were identified and initially 45 subjects were selected. They were screened using International Physical Activity Questionnaire (IPAQ) (Hagströmer M, Oja P, et al. 2006) and Physical Activity Readiness Questionnaire and You (PAR-Q AND YOU)(Canada's Physical Activity Guide to Healthy Active Living, Health Canada, 1998)among which 30 subjects fulfilling the inclusion and exclusion criteria were selected. Procedure was explained and written consent was taken in the language best understood by them. Pre-treatment assessment tests (pushup test, wall sit hold times test and VO₂ max) were done and subjects were divided into 2 groups (15 in each group) by random allocation method. Vitals (HR, RR, and BP) were assessed prior and after every exercise session. Participants were given prior instructions regarding proper clothing and footwear and were advised to maintain appropriate diet and hydration throughout the study.

Group A was given battle rope training which begun with a warm up session which included spot jogging, shoulder rotations, wrist rotations, torso rotation, hip and knee general movements. The exercise included supervised 2 sets per session initially up to 2 weeks progressing to 3 sets per session after 2 weeks each lasting for 30 seconds with a rest interval of 30 seconds after each set. A cool down session was performed for 5- 10min after the workout which included hamstring, quadriceps, calf, shoulder and biceps stretches. The workout session lasted up to 20 minutes.

Exercise variations used were:

- Shoulder circles
- Double waves
- Alternating waves
- Alternating wave-squat jump
- Alternating wave-lunge jump

Group B being the control group was given conventional exercises. The exercise protocol begun with a warm up session which included spot jogging, shoulder rotations, wrist rotations, torso rotation, hip and knee general movements. The protocol included supervised 30 seconds of each exercise with a 30 second rest interval comprising 3 sets of each exercise. A cool down session of 5-10 minutes was performed after the workout. The workout session lasted up to 30 minutes.

Exercise variations used were:

- Pushups
- Plank
- Squats
- Lunges
- Burpees

Battle rope training whereas Group B which was the control group, was given conventional exercises (Ebru calik-kutukucu, sema savci, et al. 2014). Post treatment assessments tests were done and statistical analysis was done.

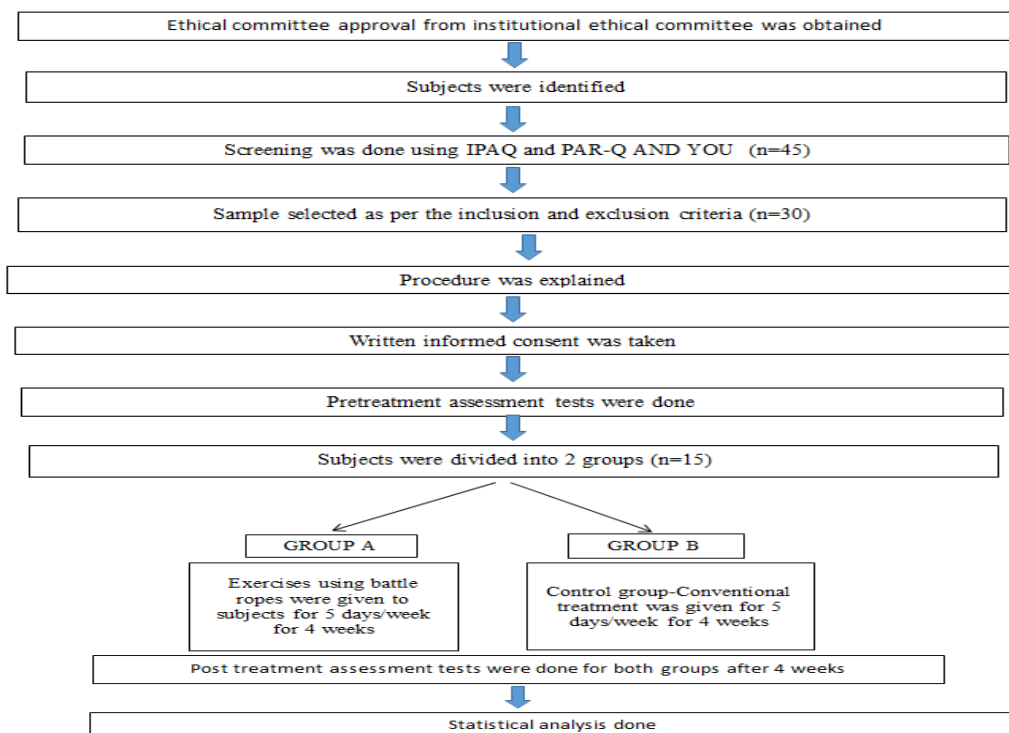


Fig 1:- Flow Chart of Procedure

Inclusion criteria for both groups:

- Males and females between 20-25 years old.
- Sedentary individuals those who had categorical score from Low to moderate level based on International physical activity questionnaire.
- Fit to participate in exercise program based on PAR-Q AND YOU
- Willing to participate in exercise program.

Exclusion criteria for both groups:

- Recent injuries or persistent pain that would refrain the subject from doing certain exercises in the HIIT protocol.
- Recent fractures.
- Cognitive disorders.
- Having any associated illness which will restricts or alter the exercise performance

There were no dropouts in the present study. All the 15 participants from each group completed the 4 week protocol without any dropout.

➤ *Outcome Measures:*

• *The Pushup Test:*

The pushup test was administered to measure the upper extremity muscle endurance. The participants were given proper instructions and demonstration prior the procedure. It was administered with male subjects starting in standard down position and female subjects with modified knee pushup position. The subject was asked to raise the body by straightening the elbows and return to the down position until the chin touches the mat. The stomach should not touch the mat. The maximum number of pushups performed consecutively without rest is counted as the score. The test was stopped when the client strained forcibly or was unable to maintain the appropriate technique. The scoring of the pushup test was done based on the ACSM guidelines (McAuslan, Colin, 2013)

• *Wall Sit Hold Times:*

Wall sit hold times test was administered to measure the lower extremity muscle endurance. The participants were given proper instructions and demonstration prior the procedure. The test was administered with subjects Standing comfortably with feet approximately shoulder width apart, with their back against a smooth vertical wall. Slowly sliding their back down the wall they assumed a position with both their knees and hips at a 90-degree angle. The timing started when one foot was lifted off the ground and was stopped when the subject could not maintain the position and the foot was returned to the ground. After a period of rest, other leg was tested. The total time in seconds that the position was held for each leg was recorded according to the ACSM guidelines (Tomchuk, D. 2011) (Nolan, Russell Patrick, 2011)

• *Estimated VO₂ Max*

Estimated VO₂ max (Ur J Appl Physiol. 2004)

It was calculated using the following formula:

$$Vo_2 \text{ max} = \text{HR max} / \text{HR rest} \times 15.3 \text{ mL/kg/min}$$

III. STATISTICAL ANALYSIS & RESULTS

Statistical analysis was done by Win pepi and Primer software. The data was entered into excel spreadsheet, tabulated and subjected to statistical analysis. Various statistical measures such as Mean, Standard Deviation (SD), tests of significance such as paired t-test and Wilcoxon and Mann Whitney test. The results were concluded to be statistically considered significant with p value < 0.005

➤ *Results:*

Group	Number of males	Number of females	Age(years) Mean ±SD	p value	t value	Inference
A	8	7	22.33 ±1.29	1.000	0.000	Not significant
B	5	10	22.33±1.29			

Table 1:- Demographic Data of Both Groups

Table 1 shows that since p value is more than 0.05 there is no statistical difference between the ages of participants in both groups suggesting the baseline data is comparable.

Groups	Pushup A	Pushup B	Wall sit hold times left A	Wall sit hold times left B	Wall sit hold times right A	Wall sit hold times right B
MEAN ± SD	8.13±3.02	8.33±3.26	9.46±2.2	9.6±2.44	10.73±2.18	11.6±2.02
p value	0.8		0.87		0.27	
Inference	Not significant		Not significant		Not significant	

Table 2:- Baseline Comparison of Pre Intervention Values of All Outcome Measures of Both Groups

Table 2 shows that the baseline data of both groups is statistically non-significant and hence baseline is comparable.

Groups	Pushup test		Wall sit hold times(Left)		Wall sit hold times (Right)	
	Pre	Post	Pre	Post	Pre	Post
A	8.33±3.27	11.73±3.58	9.47±2.2	18±3.42	10.73±2.18	11.7±2.03
p-value	0.0001		0.0001		0.0001	
Inference	Significant		Significant		Significant	
B	8.13±3.02	14.33±4.30	9.6±2.44	14.4±2.88	20.68±3.11	15.68±3.04
p-value	0.0001		0.0001		0.0001	
Inference	Significant		Significant		Significant	

Table 3:- Within Group Analysis of both Groups Pre and Post Intervention

Table 3 shows that there is a statistically significant improvement in both groups after 4 weeks of intervention suggesting both groups showed improvements in performance of pushup test and wall sit hold times test.

Pushup test	Group A	Group B	p-value	t-value	Statistical significance
MEAN±SD	6.2±1.70	3.33±0.98	0.0001	5.67	Significant

Table 4:- Inter Group Comparison of Differences of Mean in Pushup Test Performance between Group A and B

Table 4 shows that there is improvement in the pushup test performance after 4 weeks of battle rope training as compared to the control group.

Wall sit hold times test (left)	Group A	Group B	p-value	t-value	Statistical significance
MEAN±SD	8.53±1.85	4.8±1.52	0.0001	6.04	Significant

Table 5:- Inter Group Comparison of Differences of Mean in Wall Sit Hold Times Test between Group A and B of Left Leg

Table 5 shows that there is improvement in the wall sit hold times test of left leg after 4 weeks of battle rope training as compared to the control group.

Wall sit hold times test (right)	Group A	Group B	p-value	t-value	Statistical significance
MEAN±SD	9.93±2.31	4.07±1.75	0.0001	7.83	Significant

Table 6:- Inter Group Comparison of Differences of Mean in Values of Wall Sit Hold Times Test between Group A and B of Right Leg

Table 6 shows that there is improvement in the wall sit hold times test of right leg after 4 weeks of battle rope training as compared to the control group.

➤ *Descriptive Statistics for Estimated VO₂ Max:*

For the outcome measure estimated VO₂ max, normal distribution was present statistically in the values of pre and

post analysis of group A, hence paired t test was applied. Whereas, in the values of pre and post analysis of group B and inter group comparison between both groups, normal distribution was not present statistically. Hence Wilcoxon and Mann-Whitney tests were applied respectively.

Vo ₂ max	Group A	Group B	p-value	z sub T	Statistical significance
MEAN±SD	3.94±1.91	1.48±0.96	0.0001	3.78	Significant

Table 7:- Inter Group Comparison of Differences of Mean in Values of VO₂ Max between Group A and B

Table 7 shows that there is improvement in the VO_2 max after 4 weeks of battle rope training as compared to the control group.

Therefore, statistical analysis showed significant increase in the pushup test, wall sit hold times test and VO_2 max of the individuals of group A undergoing battle rope training after 4 weeks of intervention as compared to group B.

IV. DISCUSSION

The present interventional study was done to investigate the effect of Battle Rope Training in sedentary individuals as compared to the conventional exercises. The values showed significant increase in endurance parameters like Pushup test, Wall sit hold time and estimated VO_2 max as compared to the conventional group exercise. Decreased endurance leads to decreased ability of the heart to eject blood, decreased number of capillaries which delivers oxygen and food to the muscles and decreased size and number of mitochondria. The major metabolic consequences of endurance training are slower utilization of muscle glycogen and reliance on fat oxidation and less lactate production. The act of gaining endurance through physical activity has been shown to decrease anxiety, depression and stress or any chronic disease in total. In previous study (Chen, wei-han, wu, heuy-June, October 2018) done on collegiate basketball players, the primary finding was that Battle Rope Training significantly enhanced multiple physical fitness dimensions namely aerobic capacity, upper body anaerobic power, upper body power, lower body power and core endurance. Whereas regular training only enhanced aerobic capacity and upper body power. Battle Rope Training incorporates use of both upper and lower extremities. Also, some studies have stated that it activates the core muscles to certain extent. Hence it might produce an overall improvement in the exercise performance. A study (Calatayud, J Martin Calando, Benítez, 2015) stated that Battle Rope Training can be used to provide moderate to high levels of muscle activity in the anterior deltoid, external oblique and lumbar erector spinae. A previous study (Fontaine, CJ and Schmidt, 2015) found that an acute 10-minute bout of Battle rope training resulted in high heart rate and energy expenditure, which meet previously established threshold known to increased cardiorespiratory fitness. Battle rope training is goal oriented form of exercise in which the individual is given a specific target to achieve, with multiple variations. Also, it is a very enjoyable form of exercise which encourages maximum participation and adherence to the exercise protocol due to which there might be very few or no dropouts.

V. CONCLUSION

The present study concludes that battle rope training is effective in improving upper extremity endurance, lower extremity endurance and VO_2 max in sedentary individuals as compared to conventional training.

VI. CLINICAL IMPLICATION

- The study can be used to promote fitness in sedentary individuals as it is an enjoyable form of exercise.
- As it requires less time, this form of exercise can also be implemented in working population having active lifestyle.
- Since it targets various muscle groups at the same time, it provides more results in less time.

LIMITATIONS OF STUDY

- Differentiation between Males and Females was not done.
- It requires bigger space.

FURTHER SCOPE & SUGGESTIONS

- Increasing the training duration and incorporating a progressive overload should assist in the improvements.
- The study can be carried out by assessing other outcome measures like hand grip, core endurance and power.
- Since battle rope training is a physically demanding exercise program thorough evaluation should be done before engaging to this form of exercises

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