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RESEARCH ARTICLE

TO DETERMINE THE ACUTE HEMODYNAMIC RESPONSE TO 10 SETS OF PASSIVE STRETCHING EXERCISES PREFORM WITH OR WITHOUT VALSALVA MANEUVER

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ABSTRACT

Flexibility is considered a component of physical fitness that is related to health and flexibility training is recommended in different contexts. Muscle contraction during stretching exercise might increase hemodynamic response which appears to be influenced by the amount of activated muscle mass and intensity of stretching. These changes are primarily mediated by type 3 afferent fibers which are sensitive to mechanical stress. The stimulation of these peripheral mechanoreceptors includes Vagal withdrawal and increase sympathetic activity .The Valsalva maneuver is a forceful attempted exhalation against a closed airway. It can be used to clear the ears, unintentionally during coughing or a bowel movement or as a Diagnostic or treatment aid. There is a increase in heart rate blood pressure and rate pressure product due to Valsalva maneuver. The influence of the Valsalva maneuver during flexibility training routine is also requires investigation because cardiovascular response are probably greater when is perform. This maneuver might frequently be used during stretching exercise especially in case of less flexible individuals due to difficult reaching and sustaining extreme range of motion for several seconds from a practical perspective studying these variables is important because variable such as the set number length stimulus interval between sets and training method likely affect the hemodynamic responses to acute stretching exercise .although previous studies have shown that acute stretching exercise include transient hemodynamic response, the pattern of this response is controversial. So the objective of study was to compare the acute response of blood pressure, Heart rate and rate pressure product during 10 sets of passive static stretching of hamstring muscle perform with or without Valsalva maneuver. **Method**: 100 subjects with hamstring tightness with Maximum ROM of 125° for unilateral knee extension and with no previous flexibility training experience were enrolled and divided into 2 groups randomly. Group A- stretching exercise was giving for 30secs for 10 sets along with Valsalva maneuver where active breath hold was done for last 15secs of each set. Group B- stretching exercise was giving for 30secs for 10 sets without breath hold. Heart rate, blood pressure were measured before and after intervention. **Result**: when comparison was made between post hemodynamic parameters, heart rate, blood pressure and rate pressure product was significantly increased in Group A. **Conclusion:** 10 sets of hamstring stretching with Valsalva maneuver significantly increase heart rate, blood pressure and rate pressure product. The performance of Valsalva maneuver intensified all hemodynamic response, which resulted in significant increase in cardiac work during stretching exercise.

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INTRODUCTION

Flexibility is considered a component of physical fitness that is related to health and flexibility training is recommended in different contexts. Recommendations regarding flexibility training include at least 4 sets of exercise for Large muscle group perform two or three times per week to achieve positive results and to avoid overload, movements should not exceed the point of discomfort. Muscle contraction during stretching exercise might increase hemodynamic responses which appear to be influenced by the amount of activated muscle mass and intensity of stretching.

These changes are primarily mediated by type 3 afferent fibers which are sensitive to mechanical stress. The stimulation of these peripheral mechanoreceptors includes vagal withdrawal and increase sympathetic activity. Although previous studies have shown that acute stretching exercise include transient cardiovascular response, the pattern of this response is controversial. Some studies have observed an increase in arterial blood pressure, heart rate or both. However most of the studies primary focus on Mechanics associated with this variation. Neglecting aspect related to exercise prescription variables.

From a practical perspective studying these variables is important because variable such as the set number length stimulus interval between sets and training method likely affect the hemodynamic responses to acute stretching exercise. Considering the lack of studies investigating acute cardiovascular response to multiple sets of stretching exercise perform with and without the Valsalva maneuver and the importance of these aspects for exercise prescription. Hemodynamic parameters in this study mainly includes heart rate: heart rate is the speed at which heart beats. It is measured by the number of contractions of Heart per minute. Normal heart rate is 72 bpm. It ranges between 60 and 80 bpm. Tachycardia is the increase in heart rate above 100 bpm. Blood pressure: arterial blood pressure is defined as lateral pressure exerted by column of Blood on wall of arteries. Systolic blood pressure is defined as the maximum pressure exerted in the arteries during systolic phase of cardiac cycle. Normal systolic blood pressure: 120mmhg (110 mmHg to 140 mmHg). Diastolic blood pressure is defined as the minimum pressure exerted in the arteries during diastolic phase of cardiac cycle. Normal diastolic blood pressure is 80 mmHg (60mmhg to 80mmhg)Rate pressure product: rate pressure product is the product of heart rate and systolic blood pressure. Rate pressure product is a measure of stress put on cardiac muscles based on number of time it needs to beat per minute (HR) and arterial blood pressure that is pumping against (SBP). IT will be a direct indication of energy demand of the heart and thus a good measure of energy consumption of heart.

The Valsalva maneuver is a forceful attempted exhalation against a closed airway. It can be used to clear the ears, unintentionally during coughing or a bowel movement or as a Diagnostic or treatment aid. Valsalva maneuver increases the pressure in the nose. Maxillary sinuses (on the both side of the nose), mouth, throat (pharynx and larynx above and below the vocal cords) Eustachian tube, middle ear, inner ear, chest (intrathoracic pressure), eye (intraocular pressure), within the skull (intracranial pressure), in the cerebrospinal fluid (CSF), in the abdomen and rectum. The influence of the Valsalva maneuver during flexibility training routine is also requires investigation because cardiovascular response are probably greater when is perform. This maneuver might frequently be used during stretching exercise especially in case of less flexible individuals due to difficult reaching and sustaining extreme range of motion for several seconds. So the objective of study was to compare the acute response of blood pressure, Heart rate and rate pressure product during 10 sets of passive static stretching of hamstring muscle perform with or without Valsalva maneuver.

MATERIALS AND METHODS

Method of collection of data: Subjects who were voluntarily ready were screened before recruitment in the study. Out of 110 subjects, 100 subjects who matched inclusion and exclusion criteria were included in the study. An informed and written consent were obtained from each of the subjects in which the subjects were agree to participate in the study. Pulse oximeter, Watch, universal Goniometer, stethoscope, sphygmomanometer and Plinth were used during study.

Inclusion Criteria

- Subjects who are willing to participate
- Asymptomatic male and female (Age 23.5±5.5 years; body mass index 24.2±6.0 kg/m2; resting heart rate 70±8.8 bpm; Systolic blood pressure 126±9.2 mm Hg; diastolic blood pressure 70±8.6 mm Hg)
- No previous flexibility training experience
- Eligible subjects exhibited a low flexibility level, defined as a maximum ROM of 125°for the unilateral knee extension exercise.

Exclusion Criteria

- Use of medication that could potentially influence hemodynamic responses to exercise
- Any musculoskeletal, neurological and cardiorespiratory condition.

Duration of the study

1 time study

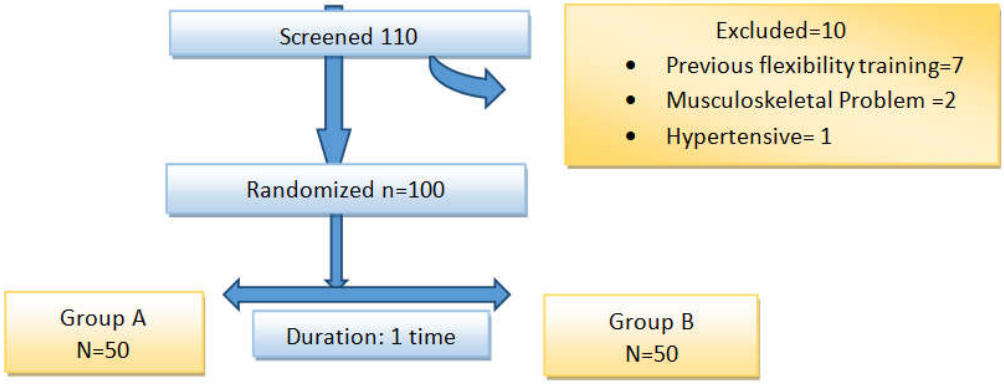
Outcome measure: Heart rate, Systolic blood pressure, Diastolic Blood Pressure and Rate pressure Product

Procedure: Subjects from Shree B.G. Patel College of physiotherapy and from surrounding who were voluntarily ready were enrolled. Subjects were screened for inclusion and exclusion criteria. Subjects fulfilling the inclusion criteria were requested to participate in the study. Informed consent forms were obtained from the subjects. Subjects were allocated into two equal groups randomly in to group A and group B. Group A- stretching exercise was giving for 30secs for 10 sets along with valsava maneuver where active breath hold was done for last 15secs of each set. Group B- stretching exercise was giving for 30secs for 10 sets without breath hold. Heart rate, blood pressure were measured before and after intervention.

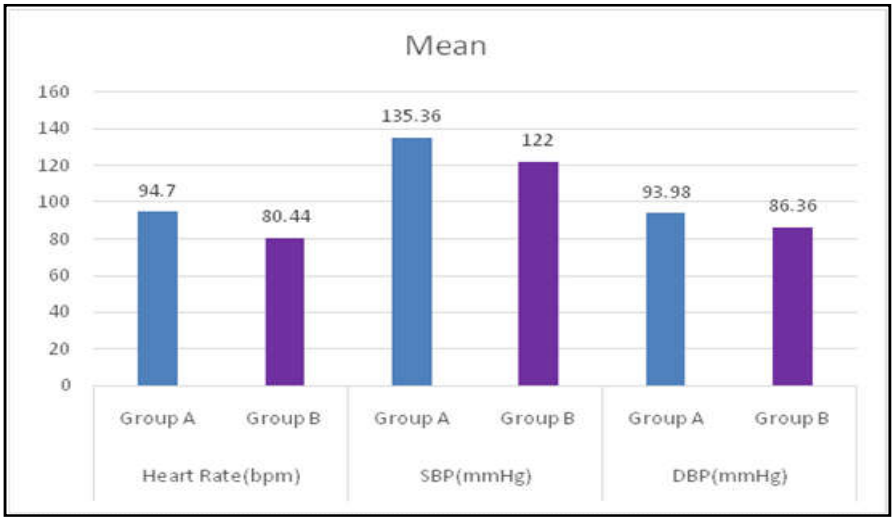
Group A (with Valsalva maneuver)

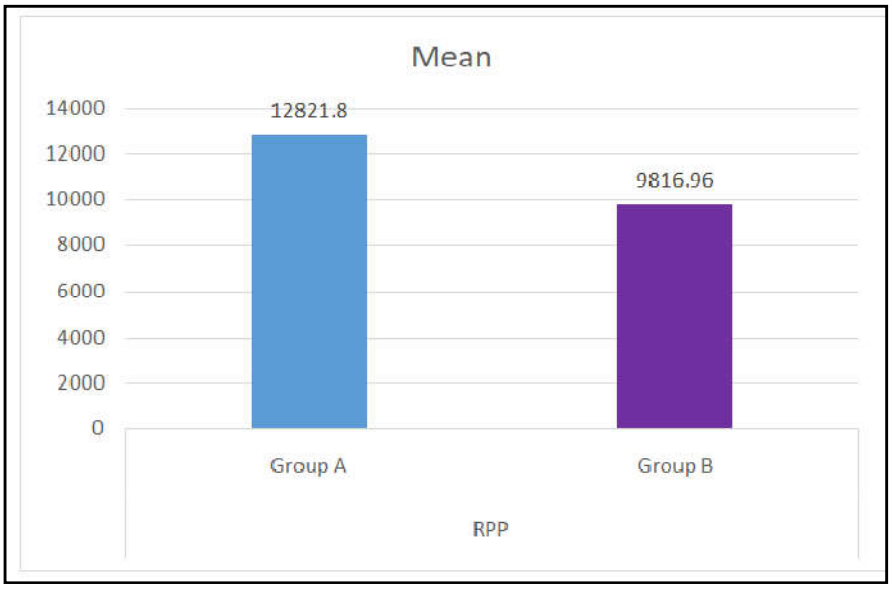
- The subject was taken in supine position on plinth
- Resting vitals of the subjects were taken
- The researchers stands on the dominant side of subject and assistant on the non-dominant side
- Unilateral knee extension exercise where standardized as follows:
- For the initial and final position the subject remained in supine position, lying on a mat
- For the intermediate position, the subject remained with 90°- 90° hip and knee flexion of tested leg.
- For the maximum intensity position, the knee joint of the tested leg is gradually extended. The maximum ROM was determined at the point associated with the subject's subjective indication of pain sensation or mechanical restriction to the movement. The ankle was free to prevent tension from being transmitted through the triceps surae and the knees were extended during entire movement. The assistant held the contralateral limb to stabilize movement.
- Passive static stretching of hamstring muscles for 10 sets of 30 second stimuli and 30 second interval between sets. Breathe was hold (Valsalva maneuver) during the last 15 seconds of stretching exercises.
- After stretching exercise the vitals were taken in supine position.

Study Algorithm



Outcome	Group		Mean	p-value	T value	Df
Heart Rate	A	Post	94.7	0.00011	20.49	98
	B	Post	80.44			
Systolic Blood Pressure	A	Post	135.36	0.00011	18.34	98
	B	Post	122			
Diastolic Blood Pressure	A	Post	93.98	0.00013	10.76	98
	B	Post	85.36			
Rate Pressure Product	A	Post	12821.8	0.00011	24.63	98
	B	Post	9816.96			





Group B (without Valsalva maneuver)

- The subject was taken in supine position on plinth
- Resting vitals of the subjects were taken
- The researchers stands on the dominant side of subject and assistant on the non-dominant side
- Unilateral knee extension exercise where standardized as follows:
    - For the initial and final position the subject remained in supine position, lying on a mat
    - For the intermediate position, the subject remained with 90°- 90° hip and knee flexion of tested leg.
    - For the maximum intensity position, the knee joint of the tested leg is gradually extended. The maximum ROM was determined at the point associated with the subject's subjective indication of pain sensation or mechanical restriction to the movement. The ankle was free to prevent tension from being transmitted through the triceps surae and the knees were extended during entire movement. The assistant held the contralateral limb to stabilize movement.
- Passive static stretching of hamstring muscles for 10 sets of 30 second stimuli and 30 second interval between sets only.
- After stretching exercise the vitals were taken in supine position.

Statistical Analysis: This study was to determine the acute hemodynamic response to 10 sets of passive stretching exercises preform with and without Valsalva maneuver. 100 patients were taken and were divided in two equal group, i.e. 50 in group A and 50 group B. Unpaired t-test were used to determine significance difference in outcome measure between two groups. Each Calculated t-value was compared with t-table value to test hypothesis at 0.05 level of significance. Data were analysed with the help of using graph pad prism 5.03 statistical tools.

DISCUSSION

In the present study 100 subjects were designated from Shree B.G.Patel College of Physiotherapy and surrounding having hamstring muscle tightness (i.e, Popliteal angle ≤125□) and were divided into two groups. Heart rate, blood pressure and rate pressure product were measure before and after intervention. The intervention included giving passive manual stretching of hamstring muscle on dominant side for 10 sets of 30 second stimuli and 30 second interval between sets. The subjects in group A were asked to hold a breath in last 15 seconds. Subject in group B were given just passive manual stretching of hamstring muscle without holding breath in last 15 seconds. And result was, when comparison was made between post hemodynamic parameters of both groups, we found that heart rate was significantly increase in group A compared to group B with a t value 20.49. Systolic blood pressure was significantly increased in group A with t value 18.34 compared to group B. There was a significant increase in diastolic blood pressure with t value 10.76 in group A. Rate pressure product was significantly increase with t value 24.63 in group A compared to group B.

Hence, Intragroup comparison shows extremely statistical significant difference in group A compared to group B. Similar type of research was conducted by Tanna Krima and Oza Falak et al. in 2016 on Comparison of cardiovascular responses with proprioceptive neuromuscular facilitation stretching on pectorals and hamstrings with Valsalva maneuver and Result was PNF stretching of hamstring with Valsalva maneuver shows significant increase in HR, SBP and DBP compared to PNF stretching of pectorals and it was concluded that PNF stretching of hamstring with VM shows significant increase in HR, SBP and DBP compared to PNF stretching of pectorals. Another similar study was conducted by Paulo T.V.Farinatti in 2010 on cardiovascular responses to passive static flexibility exercises are influenced by the stretched muscle mass and the Valsalva maneuver and result was there is increase in hemodynamic parameters after giving stretching with valsalva maneuver. These increase in heart rate, blood pressure and rate pressure product may be due to muscle contraction during stretching exercise might increase hemodynamic response, which appear to be influenced by amount of activated muscle mass and the intensity of stretching. Some mechanisms have been suggested to mediate the increase in hemodynamic responses during stretching exercises. Gladwell and Coote reported a transitory increase in HR at the start of stretching, concomitant to a decrease in parasympathetic activity, whereas Farinatti et al. suggested that the increase in HR during stretching would be related to higher sympathetic activation and vagal withdrawal.

Additionally, increases in hemodynamic responses during stretching are probably mediated by neural impulses generated by mechanical activity and transmitted by muscle receptors, particularly type III afferent fibers, which are activated by both stretching and static contraction. The afferent influx generated by these fibers is capable of inducing increases in cardiovascular responses, even during passive stretching. During active stretching performed by individuals with poor flexibility, higher muscle tension is probably needed to reach and sustain a given ROM. Therefore, a greater stimulation of type III afferent fibers might occur in subjects with lower vs. higher flexibility levels. This potential mechanism could at least partially explain the increase in hemodynamic responses presently observed. Thus, there is a significant effect of valsalva maneuver on acute hemodynamic response. Hence the alternative hypothesis is accepted.

Conclusion

The study concluded that 10 sets of hamstring stretching with Valsalva maneuver significantly increase heart rate, blood pressure and rate pressure product. The performance of Valsalva maneuver intensified all hemodynamic response, which resulted in significant increase in cardiac work during stretching exercise. In the present study alternate hypothesis is accepted and null hypothesis is rejected.

Limitation of the study

- This study can be performed with large number of population.
- This study was only restricted to subjects between 18 to 29 years of age.
- This is the short duration study
- The population included in the study was taken from only Anand district.

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