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Effect Of Knee Isokinetic And Isotonic Exercises On Blood Pressure In Normal Males

Shanmugananth E[1], Gopal Nambi[2], Abishek Godwin A[3], Oviyaa A[4], Manikumar M[5*], Menaka V[6], Velkumar V[7], Rajesh A[8]

[1]Professor and Head in Physiotherapy Department, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth, Puducherry, India
[2]Department of Physical therapy and health Rehabilitation College of applied medical science Prince Sattam Bin Abdulaziz University Al. Kharj Saudi arabia
[3]UG scholar in department of Physiotherapy, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth, Puducherry, India
[4]UG scholar in Department of Physiotherapy, Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth, Puducherry, India
[5*]Professor, SRM College of physiotherapy, SRM institute of science and Technology, Chennai, Tamilnadu, India
[6]Lecture in physiotherapy division of PM & Rehabilitation Government Medical College and Hospital, Cuddalore, Tamilnadu, India
[7]Assistant professor Mahatma Gandhi Medical College and Research Institute, Sri Balaji Vidyapeeth, Puducherry, India
[8]Lecture in physiotherapy division of PM & Rehabilitation Government Medical College and Hospital, Cuddalore, Tamilnadu, India

Corresponding author: Manikumar M*
Email: manikumarpt1977@yahoo.co.in

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Abstract

Background and Purpose: The aims and purpose of the study is to determine the effect of knee isotonic and isokinetic exercises on blood pressure in normal males. **Method:** It is a quasi-experimental study with single group which received both isokinetic and isotonic exercises. **Conclusion**: 60 normal young males were taken in the study and were given isokinetic well as isotonic exercises and their effect on blood pressure was noted. The study shows marked increase in systolic and diastolic pressure with both exercises but the changes were more in isokinetic exercise than in isotonic exercise.

Keywords: Isotonic exercises, Isokinetic exercises, Blood pressure, Normal males, Quasi-experimental study

Introduction

The measurement of arterial pressure, a vital sign, is an integral part of a comprehensive physical examination since it serves as a gauge of health status. It measures long-term cardiovascular risk, evaluates suitability for specific occupations, and screens for hypertension. High blood pressure poses a significant risk of various vascular diseases, such as cardiovascular, cerebrovascular, and renovascular, even though low blood pressure needs immediate medical attention. (1) It has been demonstrated that exercise reduces elevated sympathetic nervous system activity, which is associated with hypertension. Individuals with normal blood pressure have also been observed to benefit from regular exercise by lowering their resting blood pressure and curtailing their sympathetic outflow. (2) Mechanical compression of the peripheral arterial vessels supplying the active muscles occurs during straining exercise, especially during concentric or static action. By increasing peripheral resistance and decreasing muscle perfusion, this compression causes a decrease in muscle perfusion. When the maximum force capacity of the muscle is exceeded, blood flow to the muscles reduces directly. Cardiovascular output and mean arterial pressure increase along with sympathetic nervous system activity to restore muscle blood flow. (3) Exercises that enhance muscle strength, endurance, and power are known as resistance training or weight training. (4) These strengthening exercises may include isotonic and isokinetic exercises. (5)

Isotonic Exercises

With this type of exercise, muscles are contracted and joints move at varying speeds while external resistance remains constant. (6,7)

ISOKINETIC EXERCISES

An isokinetic dynamometer, for example, controls the speed at which muscles shorten or lengthen, and the angle of the limbs (8-12). In addition to improving muscle strength and preserving fat free mass, resistance exercise is a valuable part of cardiac rehabilitation programs. (13) Weightlifting arm exercises performed at 50, 65, and 85% of 1 RM were safe and effective even for patients with advanced heart disease. (14) Cardiovascular rehabilitation has used resistance training controversies until recently. Studies suggest resistance training is safe for cardiopulmonary patients with low intensity, slowly progressed and poorly monitored, as long as it is done at a low intensity, is progressed fairly slowly, and is monitored closely. (15) It may be preferable to conduct assessment, training, and rehabilitation using isokinetic exercise in older adults since joint stress is a major concern for exercise. In some studies, however, cardiovascular stress associated with isokinetic exercise has been suggested to be substantial, which has recommended that cardiovascular screenings be performed before such exercise. It has been observed in many studies of neuromuscular function that muscle strength decreases with age. As we walk downstairs, lower weight with our arms, and sit down, we use our muscles every day. While such exercises are more challenging for older people clinically, they are easier to perform from a functional perspective. (10,11,12) Thus, the study aims to measure cardiovascular stress defined as a rise or change in blood pressure during isokinetic and isotonic knee extension exercises.

Methodology

Study design was quasi experimental with single group which received both isokinetic and isotonic exercises. A sample of 60 normal young males was taken who volunteered for participation in the study was included in the study. They were taken from the University. The subjects were taken after meeting the inclusion and exclusion criteria. First 30 Normotensive males (13), within the age group 20 to 30 years (13,18) and only the willing subjects are been taken. Smokers and uncooperative subjects are excluded. Subjects who have undergone any lower limb fractures, surgeries, under medication for Hypertension. Subjects with any Cardiovascular, pulmonary and musculoskeletal conditions are excluded. Subjects for whom exercises are limited due to any Neurological conditions.

Procedure

All the participants were given verbal explanation about the purpose, risk, benefits and procedure of the study thoroughly. An informed consent was taken so that their willingness to participate in the study was established in written knowing all the risks and benefits of it. Then all of them were assessed prior to inclusion on the basis of assessment form. Initially the subjects were asked to take rest for 10 minutes. Then the blood pressure was measured on the left upper extremity by mercury sphygmomanometer in sitting position. The subjects performed 5 minutes of warm up including stretching and static cycling before the exercises. The subjects then first performed isokinetic exercise on isokinetic dynamometer then blood pressure was again measured after 1, 2 and 3 minutes immediately after the completion of the exercise. This was followed by the cool down session of 5 minutes after the exercise. Isotonic exercise was performed after the gap of 48 hours with free weights on quadriceps chair in the same sequence as isokinetic exercise.

Protocol

Isokinetic protocol (19)

Bilateral knee exercise was performed on isokinetic dynamometer with following protocol.

SPEED (DEG\SEC)	210	150	90	30
REPITITION	10	10	10	10
SETS	2	2	2	2

REST – 1 min between each set

Isotonic protocol (7)

Bilateral knee exercise was performed with free weights on quadriceps chair with following protocol.

10 LIFTS WITH	½ 10RM (REPETITION MAXIMUM)
10 LIFTS WITH	¾ 10 RM
10 LIFTS WITH	10RM

REST – 1 min between each set

Results Analysis

Isokinetic exercise

The mean value for SBP before exercise was 124.2 ± 4.09 mm of Hg and for DBP was 82.47± 4.32 mm of Hg. The mean value for SBP after exercise as 153.6±10.1 mm of Hg and for DBP was 94.915.24 m was mm of Hg. Paired t test was done to compare the mean difference for pre and post values of SBP and DBP for isokinetic exercise. The results were found to be significant with $P < 0.05$.This is clearly shown in table 5.1.

Isotonic exercise

The mean value for SBP before exercise was 124.2±4.09 mm of Hg and for s 82.47+4.32 mm of Hg. The mean value for SBP after exercise was DBP was 137.60±6.68 mm of Hg and for DBP was 93.03±4.64 mm of Hg. Paired t test was done to compare the mean difference for pre and post values of SBP and DBP for isotonic exercise. The results were found to be significant with $P<0.05$.This is clearly shown in table 5.2.

Comparison of blood pressure changes with isotonic and isokinetic exercises

The mean value for SBP for isokinetic after the exercise was 153±10.1mm of Hg and for DBP was 94.9±5.24 mm of Hg. While the mean value for SBP for isotonic after the exercise was 124.2+4.09 mm of Hg and for DBP was 93.03±4.64 mm of Hg. Paired t test was done to compare the mean difference for post SBP and DBP values of isokinetic and isotonic exercises. The result was found to be significant with $P<0.05$.This is clearly shown in table 3.

Discussion

This study utilized isokinetic and isotonic protocols to enhance muscle endurance and work capacity. Several blood pressure readings were taken prior to, during, and after exercise. The first, second, and third readings were taken before, during, and after the exercise. It was determined that the first post-exercise measurement had the highest reading among the three. The study revealed two key findings. The systolic and diastolic blood pressure increased significantly with both isokinetic and isotonic exercise. The second difference between isokinetic and isotonic exercises is that isokinetic exercise affected blood pressure more than isotonic exercise. A systolic blood pressure increase of 29.4 mmHg occurred during isokinetic exercise, whereas a diastolic blood pressure increase of 12.5 mmHg occurred during isotonic exercise. According to Greek et al. (1984), five females aged 33 to 49 years responded to strength training exercises by varying their maximum voluntary contractions from 75 percent to 100 percent. A significant difference was also found between continuous isokinetic exercise and free weight exercise, suggesting that the intensity of effort is likely higher during isokinetic exercise. (5)

A study examined the upper limb isokinetic performance of 15 male subjects aged 19-35 years old. Blood pressure measurements were taken immediately after exercise and every two minutes for the first six minutes after recovery. Increasing exercise speed was associated with an increase in systolic blood pressure. The recovery blood pressure was not analyzed statistically, but was recorded to ensure that baseline values had been returned. (20) It has been suggested that a significant rise in arterial pressure can be attributed to the mechanical compression of contracting muscles and the associated pressor reflex. Another study noted such a phenomenon following isokinetic and isotonic exercises (15,20).

A rise in cardiac output leads to an increase in systolic blood pressure, which in turn is linked to an increase in venous return. An increase in muscle and thoracic pump activity during exercise increases venous return by increasing blood mobilization from visceral organs, increasing pressure transmitted to veins by dilated arterioles, and decreasing vein blood volume through nonadrenergically mediated venoconstriction. A study explained that an increase in stroke volume is the main cause of an increase in cardiac output. (22)

The results of this study suggest that maximal effort is primarily required for isotonic exercise in both inner and outer ranges. Isokinetic exercise, on the other hand, combines isometric upper limb activity with isotonic lower limb activity through gripping the handles of the isokinetic machine. Therefore, both types of exercise show distinct cardiovascular trends. (16) Based on testing of standard lower limb isokinetics, these findings are in line with those of Karyn Solomon. Both the subject and the therapist may not recognize the significant cardiovascular stress caused by maximal isokinetic testing. (16)

Limitations

The study was of short duration so long term effect of the exercises was missed out. Study was done on only young males so generalization of the study is less. The resistance of the two protocols used in the study were not quantified. Generalizability of the study was less as small age group of 20 to 30 years was taken.

Conclusion

60 normal young males were taken in the study and were given isokinetic well as isotonic exercises and their effect on blood pressure was noted. The study shows marked increase in systolic and diastolic pressure with both exercises but the changes were more in isokinetic exercise than in isotonic exercise.

Table 5.1 shows mean, std deviation, std error mean, degree of freedom, t and p value before and after isokinetic exercise.

Variables		Mean	Standard deviation	Standard Mean error	Df	t	p
SBP	PRE	124.2	4.09	0.53	59	21.4	<0.0001
SBP	POST	153.6	10.1	1.31	59	21.4	<0.0001
DBP	PRE	82.47	4.32	0.56	59	18.8	<0.0001
DBP	POST	94.9	5.24	0.68	59	18.8	<0.0001

Figure 5.1 shows blood pressure changes with isokinetic exercise

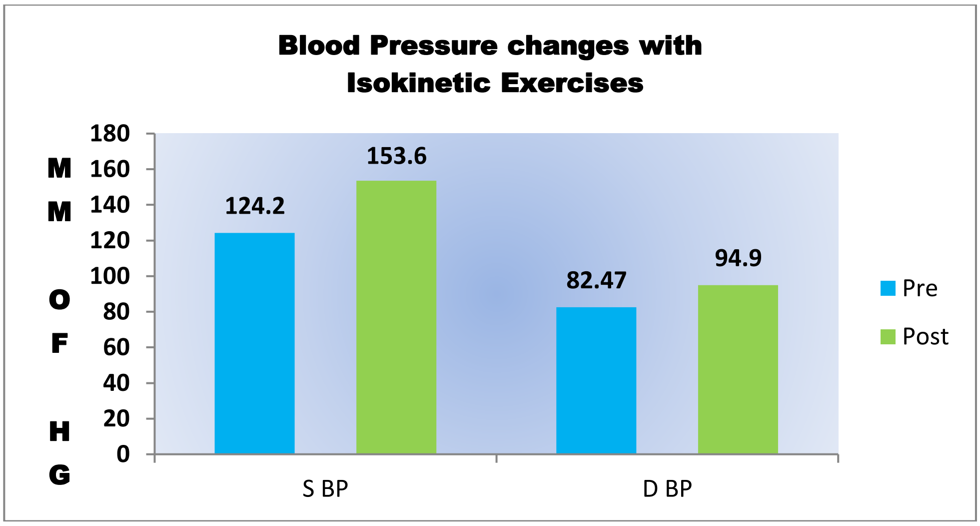


Table 5.2 shows mean, std deviation, std error mean, degree of freedom, t and p value before and after isokinetic exercise.

Variables		Mean	Standard deviation	Standard Mean error	Df	t	p
S BP	PRE	124.27	4.09	0.53	59	17.04	<0.0001
S BP	POST	137.60	6.68	0.86	59	17.04	<0.0001
D BP	PRE	82.47	4.32	0.56	59	24.23	<0.0001
D BP	POST	93.03	4.64	0.60	59	24.23	<0.0001

Figure 5.2 shows blood pressure changes with isotonic exercises

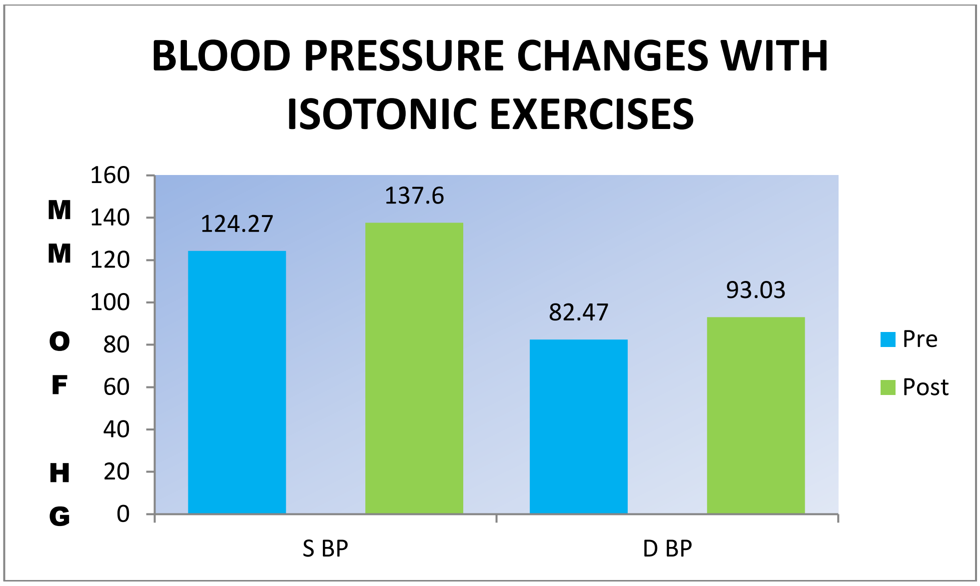
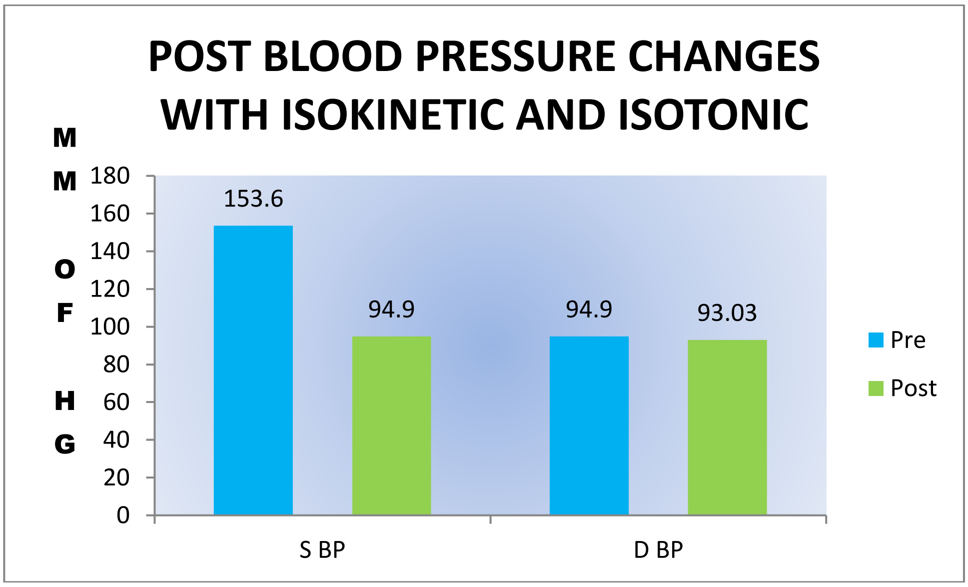


Table 5.3 shows mean, std deviation, std error mean, degree of freedom, t and p value for post isokinetic and isotonic exercises.

Variables	Exercise		MEAN	STD DEVIATION	STD ERROR MEAN	Df	t	p
SBP	ISOKINETIC	POST	13.6	10.1	1.31	59	12.4	<0.0001
SBP	ISOTONIC	POST	137.60	6.68	0.86	59	12.4	<0.0001
DBP	ISOKINETIC	POST	94.9	5.24	0.68	59	2.21	<0.0001
DBP	ISOTONIC	POST	93.03	4.64	0.6.	59	2.21	<0.0001

Figure 5.3 shows comparison of post blood pressure changes with isotonic and isokinetic exercises



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