

EFFECT OF REPETITIVE MCKENZIE LUMBAR EXERCISES ON THE CARDIOVASCULAR SYSTEM OF NORMAL INDIVIDUALS

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ABSTRACT

The McKenzie exercises revolves around a system of classification to accurately diagnose the cause of patient's pain. The studies have indicate that all forms of exercise seem to be effective in reduction B.P. The study design was an experimental study and conducted in girls hostel of Guru Jambheshwar University of science and technology, Hisar. The study was carried out on 80 normal subjects consisting of healthy young females of different age groups. Subjects who are hypertensive, Subjects with low back pain pathology and non-cooperative patients were excluded. The result of this study shows that the repetitive McKenzie lumbar flexion exercises in standing position (FIS) showed a statistically significant difference in comparison with other McKenzie lumbar spine exercises (Flexion in standing, extension in lying and Extension in standing). There is no statistically significant difference between FIL, EIL and EIS McKenzie exercises. Repetitive McKenzie lumbar flexion exercises in standing position has a marked dynamic stress on the cardiovascular system of normal individuals in comparison with other McKenzie exercises i.e. Flexion in lying, Extension in lying, and Extension in standing.

KEYWORDS: McKenzie Lumbar Flexion Exercises, Cardiovascular System

During the 1960's, Robin McKenzie developed his own examination and treatment methods for spinal disorders, and is now recognized internationally as an authority on the diagnosis and treatment of low back pain.

The McKenzie method is not just extension exercises. In its reality, McKenzie is a comprehensive approach to the spine based on good principles. The central theory of McKenzie's principles was the concept that spinal extension was a primary technique for pain management. The main tent of the McKenzie technique is a concept known as centralization whereby the patient attempts to extend his or her muscles in such a way that the pain experienced goes back to the center of the back. Centralized back pain is preferable to pain that radiates away to the legs, stomach, or shoulders.

The McKenzie exercises revolves around a system of classification to accurately diagnose the cause of patient's pain. The three classifications are postural in which problems caused due to the stress of soft-tissue caused by incorrect posture, dysfunction in which pain caused due to tissue being shortened because of scars, and Derangement in which there is change in the position of the vertebra due to fluid imbalances in the discs.

McKenzie Technique is non-specific and significant changes occurs within 10- 15 repetitions and numbers of times in a day. It varies according to the syndrome to be treated, the effect to be obtained and the

capability of the patient. Exercise should be performed with almost continuous rhythm. On each contraction, the maximum possible range must be maintained for a second or two followed by relaxation and a brief pause of only a fraction of a second.

The McKenzie method is based on finding a cause and effect relationship between the positions the patient usually has while sitting, standing or moving and the generation of pain as a result of those positions or activities. The McKenzie assessment is a comprehensive and logical step by step process to evaluate the patient's problem quickly.

McKenzie exercises helps to reduce pain in the back by stretching the spine and surrounding muscles. McKenzie treatment prescribes a series of individualized exercises. The exercises are as- follows- lying prone, extension in lying, sustained extension, extension in standing, extension mobilization, extension manipulation, rotation mobilisation in extension, rotation manipulation in extension, sustained rotation/mobilisation in flexion, rotation manipulation in flexion, rotation manipulation in flexion, flexion in lying, flexion in standing, flexion in step-standing, correction of lateral- shift, self- contraction of lateral- shift.

McKenzie treatment uniquely emphasizes education and active patient involvement in the management of their treatment in order to decrease pain

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quickly, and restore function and independence, minimizing the number of visits to the clinic.

Blood pressure refers to the force which the blood exerts against a vessels wall. The heart is an intermittent pulsatile pump and pressure is measured at both the highest and lowest points of the pulse. These points are represented by the systolic (ventricular contraction) and the diastolic (ventricular relaxation) pressures. The systolic pressure is the highest pressure exerted by the blood against the arterial walls and the diastolic pressure is the lowest pressure. The difference between the two pressures is called the pulse pressure. The range of B.P. is 120-130 mm hg/80-90 mm Hg. The equipment required for recording blood pressure is sphygmomanometer and a stethoscope.

A sedentary lifestyle is a major risk factor for cardiovascular disease. For example- people who are less active have a 30%- 50% greater incidence of hypertension than their more active peers. Further more, clinical trials have shown that physical activity may reduce blood pressure in hypertensive and normotensive individuals, independent of changes in weight. The B.P. reduction does not seem to depend on frequency or intensity of aerobic exercise or on type of exercise. The studies have indicate that all forms of exercise seem to be effective in reduction B.P. Aerobic exercise appears to have a slightly greater effect on B.P. in hypertensive patients. This effect of exercise on insulin, therefore might be one possible explanation for the beneficial effect of regular exercise on B.P.

The results of this study suggest that repetitive Mckenzie flexion exercise for lumbar spine in standing elicit hemodynamic stress. They increase the work of the heart in people with no known spinal impairments and no cardiovascular or cardiopulmonary insufficiencies. These effects are greater with increased number of repetitions. Cardiovascular demands become greater after 20 repetitions in flexion in standing than other 3 sets of exercise i.e. extension in standing, flexion in lying and extension in lying.

According to J ApplPhysiol in 1994, studied to determine the differences in cardiovascular response between high- intensity eccentric and concentric isokinetic contraction in healthy young adults, was evaluated on 9 healthy men o age 24.1-25.3 years. ECC and CON were randomly selected as each se t consisted of a high- intensity bout of 60s of ECC and CON isokinetic contraction of flexor carpi radialis. It was concluded that cardiovascular

response by a high intensity contraction is smaller in ECC than in CON and high- intensity ECC has been suggested to be exert only sm,all stress to cardiovascular system.

(Scandinavian Society of CLINICAL PHYIOLOGY and Nuclear Medicine)

According to Howden R et al. in 2002, studied the efforts of isometric exercises training on rsting blood pressure and orthostatic tolerance in humans, was evaluated on 27 subjects 9 training or control group) performed 5 weeks of isometric exercise training of the legs, and after an 8 weeks intervening period, a 2nd training group (6 subjects) undertook 5 weeks of isometric arm training. It was concluded that lower resting blood pressure is probably not responsible for the increased orthostatic tolerance after isometric training of the legs.

(Experimental physiology)

(According to Donato m et al. In 2003, studied to determine the effects of isometric exercise and with coronary lesion (11 patients). Patients subjected to a cardiac catheterization performed isometric exercise until their heart rate increased in 32+/-9% compared to baseline. It was concluded that the isometric exercise decreases the relaxation rate and increase the left ventricular end diastolic pressure in patients with aortic stenosis and left ventricular hypertrophy.

[Medicina (B Aries)]

According to JP Fischer et al. in 2005, studied on cardiovascular responses to humans calf muscle stretch during varying levels of muscle metaboreflex activation, was evaluated on 8 subjects (7 males and 1 female) performed 90s of isometric calf plantar flexion at 0,30,50 and 70% of maximum voluntary contraction and for 3.5 minute post- exercise, circulatory occlusion was ensured by inflation of a thigh- cuff and muscle was stretched for 60s. it was concluded that cardiovascular responses to human calf stretch are independent of the level of concurrent muscle metaboreflex activation.

(Journal of Physiology)

According to Vallejo et al in 2006,studied on cardiovascular responses to eccentric and concentric resistance exercise in older adults, was evaluated on 19 older persons(15 women and 4 men) of age 65-69 years and 19 young reference control (10 women and 9 men) of age 25-26 years and they were given eccentric only and concentric only exercise bouts 5-7 days apart. It was

concluded that eccentric resistance exercise produced less cardiopulmonary demands and may be better suited for older persons with low exercise tolerance and at risk of adverse cardiopulmonary events.

(Journal of Ageing)

According to Tokizawa K. in 2006, studied on cardiovascular responses to static extension and flexion exercise at 4 upper and lower- limb joints, was evaluated on 8 males performed a 2 min. static contraction at 30% of maximal voluntary torque followed immediately by 2 min. post- exercise muscle ischaemia. It was concluded that the cardiovascular responses to extension and flexion differ between arms and legs, partly arising from activation of muscle metaboreflex.

(European Journal of Applied physiology)

According to Rodrigo P. da Silva et al. in 2007, studied on the effects of cardiovascular response of high- velocity resistance exercise protocols in older women, was evaluated on 12 healthy volunteers (62.6- 64.9 years of age) performed 3 different protocols in bench press which involved 30 sets of 10 repetitions performed with a 10 RM load and 2 min. rest in between. Continuous protocol involved 10 repetition with no pause in between and Discontinuous protocol were performed with a pause of 5 or 15 sec. between 5th and 6th repetitions. It was concluded that Discontinuous high- velocity resistance exercise has a lower cardiovascular demand than continuous resistance exercise in older women.

(Journal of Sports Science and medicine)

According to Jianhua L. et al. In 2006, studied to observe the influence of duration of isometric contraction on blood pressure of healthy young males, was evaluated on 16 normal young males in which blood pressure was measured before and after 3 sessions of push-up exercise. It was concluded that only systolic blood pressure was increased irrespective of isometric contraction exercise time and no significant differences was found in systolic blood pressure among isometric contraction exercise time.

(Journal, of physiology and Therapeutic Science)

According to Yamauchi J. in 2008, studied to examine the effects of maximum static and dynamic forces during and after knee- hip extension movement on blood pressure. Blood pressure was measured before, during immediately after and 30s after knee-hip extension movements performed under maximum isometric and

various isotonic force conditions on servo- controlled dynamometer. It was concluded that measurements of muscular function with isotonic trials cause smaller increase in blood pressure than isometric trials.

(European Journal of Applied Physiology)

According to Demoulin C et al in 2009, studied to investigate the cardiovascular response to standard static assessments of strength and endurance of trunk extensor muscles, was evaluated on 10 healthy men (age 48.5-53.6 years) and 10 healthy women (age 49-54.7 years) in which trunk extensor performance were assessed by means of a Maximum static strength test and 2 static endurance tests. It was concluded that standard static endurance tests yield sizeable functional stress on cardiovascular system.

(Journal of musculoskeletal pain)

METHODOLOGY

The study design was experimental study and conducted in girls hostel of Guru Jambheshwar University of science and technology, Hisar. The study was carried out on 80 normal subjects (healthy young females) of different age groups. Subjects who are hypertensive, Subjects with low back pain pathology and non-cooperative patients were excluded.

PROCEDURE AND PROTOCOL

All the normal subjects(without hypertension and low back pain pathology) were personally contacted by the investigator. The patients were explained about the aims and objectives of the study. Consent was taken before entering into the study after thoroughly explaining the procedure.

Measurement of the Blood Pressure

A sphygmomanometer and a stethoscope were used to measure the blood pressure of the subjects. They were used to assess the pre-exercise and post- exercise readings of the blood pressure. During measuring the blood pressure, subject was in sitting position. The arm was exposed and sphygmomanometer was placed at heart level with elbow extended. The blood pressure cuff was wrapped around the arm approximately 1 to 2 inches above antecubital fossa and the center of cuff should be in the line with the brachial artery. The brachial artery was palpated and diaphragm of the stethoscope was placed over the artery. After closing the valve of the blood pressure cuff, it was pumped until the manometer registers approximately 20 mm Hg above the

anticipated systolic pressure. Then, the valve was released carefully. The manometer was being watched closely and noted the point at which the 1st sound is heard(represent systolic pressure). Carefully air was released continuously and noted the point when the sound becomes first muffled(represents diastolic pressure). Thus, reading of the blood pressure were recorded.

Repetitive McKenzie Lumbar Exercises

To examine the cardiovascular effects of the 4 exercise groups, we randomly assigned subjects so that each group consisted of 20 subjects. . The exercise group were designated as flexion in lying (Fig. 1.1), extension in lying (Fig .1.2), flexion in standing (Fig. 1.3) and extension in standing (Fig. 1.4)These exercises were performed in an almost continuous rhythm. On each movement, the subjects reached the maximum possible end- range of their lumbar spine in the direction of movement and maintained the positions for 1 or 2 seconds before the next repetition. For the purpose of our study, subjects were instructed not to hold their breath. 20 repetition of each exercise group were performed b the subjects.



Figure 1.1: Flexion in lying

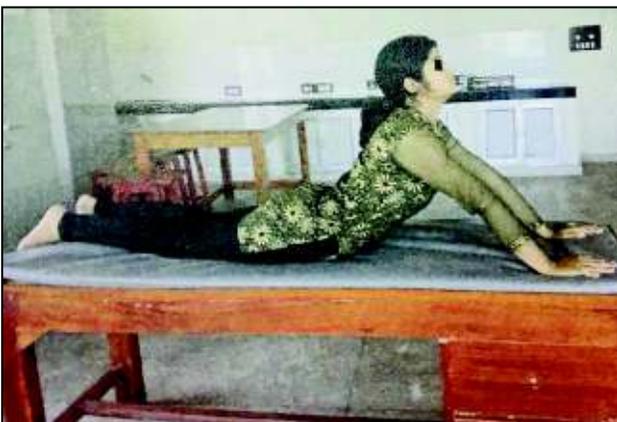


Figure 1.2: Extension in lying



Figure 1.3: Flexion in standing



Figure 1.4: Extension in standing

Blood pressure after repetitive Mckenzie Lumbar Exercises

After doing 20 repetitions of exercises by the subjects in each exercise group, the blood pressure was recorded with the help of a sphygmanometer and a stethoscope.

DATA ANALYSIS

Descriptive Analysis

Group Characteristics

4 groups were taken: Group A (EIL), Group B (EIS), Group C (FIL) and Female subjects (20 subjects) in each group (Table 1.1 and Graph 1.1).

Mean B.P. of Group A (EIL): 1.80

Mean B.P. of Group B (EIS):-0.20

Mean B.P. of Group C (FIL):1.70

Mean B.P. of Group D (FIS):6.80

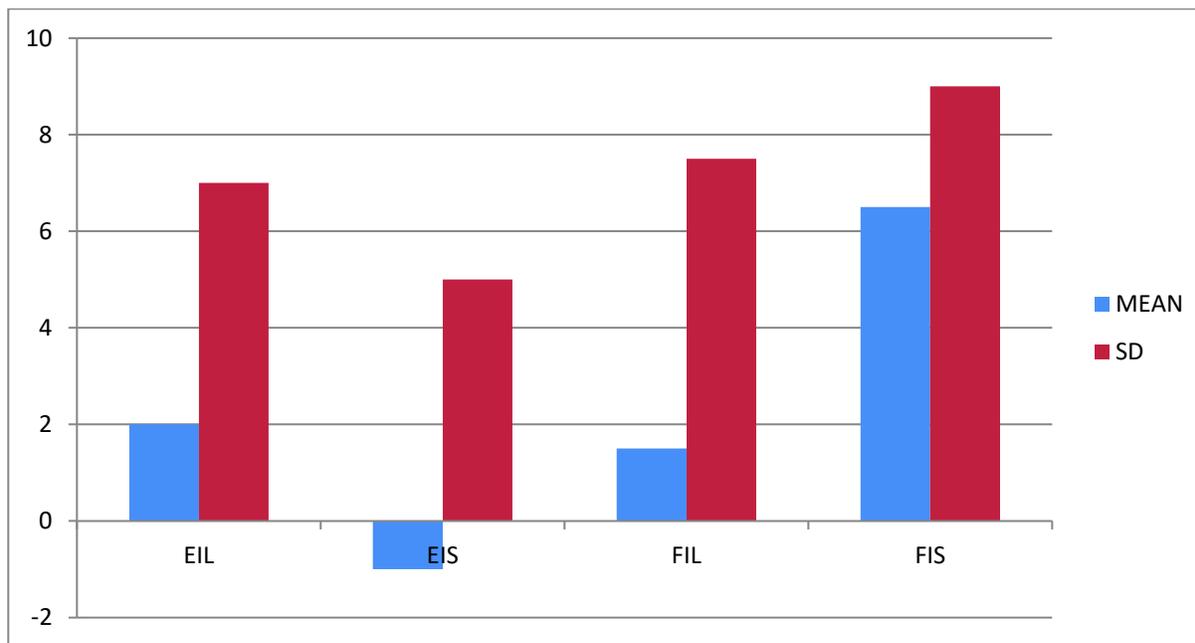
Unrelated One Way Anova was used to test for any difference in all four treatment groups. This value was compared to a table(1.2) of critical value for F at different probability level (p-value) based on sample size.

Statistical software used was SPSS version 15.0

Table 1.1: Comparison of mean, standard deviation and standard error for EIL, EIS, FIL and FIS

Group	No. of Subjects	Variables	Mean	Standard Deviation	Standard Error
EIL	20	NBP	120.50	8.48	1.90
		AFBP	122.30	9.87	2.21
		DBP	1.80	7.22	1.62
EIS	20	NBP	114.10	8.57	1.92
		AFBP	113.90	7.47	1.67
		DBP	-0.20	5.06	1.13
FIL	20	NBP	117.00	8.19	1.83
		AFBP	118.70	12.09	2.70
		DBP	1.70	7.63	1.71
FIS	20	NBP	114.50	8.20	1.83
		AFBP	121.30	10.73	2.40
		DBP	6.80	9.70	2.17

(EIL= Extension In Lying, EIS= Extension In Standing, FIL=Flexion In Lying, FIS= Flexion In Standing, NBP=Normal Blood Pressure, AFBP=Blood Pressure After Exercise, DBP= Difference In Blood Pressure)



X- axis indicates groups and Y- axis indicates mean changes in B.P.

Graph 1.1: Comparison of mean for EIL, EIS, FIL and FIS

Table 1.2: Comparison between EIL, EIS, FIL and FIS using unrelated one way analysis of variance

Source of variation	DF	SS	MS	F	P>F
Between groups	3	538.150	179.383	3.12	0.0309
Error	76	4371.800	57.523		
Corrected total	79	4909.950			

DF= Degree of freedom, SS= sum of square, MS= mean square, F=F- ratio

Table 1.3: For multiple comparison of EIL, EIS, FIL and FIS

Comparison	Standard Error	T	P>T	Significant?
EIL	1.615	1.114	0.2790	No
EIS	1.132	-0.176	0.8617	No
FIL	1.706	0.996	0.3316	No
FIS	2.168	3.135	0.0054	Yes

After multiple comparison it is found that flexion in standing(FIS) has a marked significant difference as compared to flexion in lying(FIL), extension in standing(EIS) and extension in lying(EIL)(Table,1.3).

RESULTS

The result of this study shows that the repetitive McKenzie lumbar flexion exercises in standing position (FIS) showed a statistically significant difference in comparison with other McKenzie lumbar spine exercises (FIL, EIL and EIS). There is no statistically significant difference between FIL, EIL and EIS McKenzie exercises.

CONCLUSION

Repetitive McKenzie lumbar flexion exercises in standing position has a marked dynamic stress on the cardiovascular system of normal individuals in comparison with other McKenzie exercises i.e. Flexion in lying, Extension in lying, and Extension in standing.

DISCUSSION

Flexion in standing appears to requires the eccentric contraction of back muscles, followed by their concentric contraction to return to the upright position. Because the ROM during back extension is less than during flexion, there is presumably less muscle work, and therefore, less work of the heart in extension as compared with flexion in both the lying and standing positions.

The study conducted by Al-Obaidi et al. in 2001 on cardiovascular responses to repetitive McKenzie lumbar exercises, concluded that after 20 repetitions, the work of the heart was different across all exercise groups(i.e. FIL>EIL>FIS>EIS).

The result of our study support the hypothesis that repetitive McKenzie exercises for the lumbar spine elicit

haemodynamic stress. They increase the work of the heart in people with no known spinal impairments and no cardiovascular or cardiopulmonary insufficiencies. Because an increased B>P> is an indicator of increased myocardial oxygen demand, the result of our study strongly support the idea that flexion in standing typically performed within 1 min, represent a risk for a patient with underlying cardiovascular dysfunction. This is especially true for people with risk factors and who may have asymptomatic or symptomatic cardiovascular disease, cardiopulmonary disease, or hypertension.

Our result indicate that physical therapists should consider monitoring the cardiovascular status of patients with spinal impairments for which McKenzie exercises are indicated.

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