EEffects of combined stretching technique with deep breathing exercise on O_2 saturation, blood pressure and heart rate in post CABG patients

Dr. Namra chughtai PT[1], Dr. Qurat-ul-ain PT[2], Dr Fatima Liaqat PT[3], Dr. Rabia Hashmi PT[4], Dr. Shanza Tanveer PT[5], Dr. Sabahat Ali Sheikh PT
[1,2,3] Riphah international university Lahore
[4]Al Mustafa medical and dental center Lahore
[5]Doctors Institute of Health Sciences, Sargodha
[6]University of Lahore, Sargodha campus

ABSTRACT
Background: Coronary artery bypass grafting (CABG) is an open-heart surgery that involves grafting a piece of a blood vessel from the aorta to the coronary artery in order to bypass a blocked section of the coronary artery and enhance blood flow to the heart. CABG surgery is still a high-risk treatment, and many patients experience postoperative chest and pulmonary complications.
Objective: To determine the effects of combined stretching technique with deep breathing exercise on O2 saturation, blood pressure and heart rate in post CABG patients.
Method: There was a randomized controlled trial. 24 individuals were recruited and assigned to Groups A and B based on sample selection criteria. A pulse oximeter and a manual mercury sphygmomanometer were used to measure oxygen saturation, blood pressure, and heart rate. The approach of non-probability convenient sampling was applied. After the sixth week of treatment, both groups were reviewed. Treatment time was 15-25 minutes. SPSS 25 was used to analyses the data.
Results: There was a statistically significant change within both groups in the pulse oximetry, blood pressure and heart rate with p- value of < 0.05. Both were effective but performing stretching technique with deep breathing exercise showed more improvement.
Conclusion: Stretching with deep breathing exercises was more effective than baseline treatment in improving oxygen saturation, reducing blood pressure, and increasing heart rate in CABG patients.
Key words: Cardiac rehabilitation, Deep-breathing exercise, Exercise; Physical activity

I. INTRODUCTION

Coronary artery disease is a leading cause of death in most developed countries. From the 1990s to the 2000s, mortality from acute myocardial infarction decreased by 50%.(1) The prevalence of CAD is related to age, gender, and socioeconomic status. Lipid disturbances, thrombosis, inflammation, vascular smooth cell activation, remodeling, platelet activation, endothelial dysfunction, oxidative stress, altered matrix metabolism, and genetic factors are all involved in atherosclerosis.(2) Many people in the general population have risk factors for CAD, which include hypertension, lipid and lipoprotein metabolism disturbances, diabetes mellitus, chronic kidney disease, age, gender, lifestyle, cigarette smoking, diet, obesity, and family history.(3) Angina pectoris is caused by myocardial ischemia and manifests as pain in the chest or adjacent area, usually as a result of exertion and linked to a myocardial function disorder. Typical angina pectoris would last for minutes before gradually worsening.(4) Patients with angina usually prefer to rest, sit, or stop walking, and reaching maximum intensity in seconds is unusual. Rest or the use of nitroglycerin can relieve typical angina pectoris within minutes.(5) The new MI criteria were required due to the increasing use of sensitive MI biomarkers and precise imaging techniques such as electrocardiography (ECG), computed tomography, and cardiac magnetic resonance imaging.(6) Left ventricular dysfunction, cardiogenic shock, structural complications, arrhythmia, recurrent chest discomfort, recurrent ischemia and infarction, pericardial effusion, pericarditis, post-myocardial infarction syndrome, venous thrombosis pulmonary embolism, left ventricular aneurysm, left ventricular thrombus, and arterial embolism are all complications of acute myocardial infarction.(7) Coronary artery bypass graft (CABG) is a significant careful activity where atheromatous blockages in a patient's coronary courses are skirted with gathered venous or blood vessel channels.(8) The detour reestablishes blood stream to the ischemic myocardium which, thusly, reestablishes capacity, practicality, and eases angina side effects.(9) Coronary artery bypass graft (CABG) surgery is defined as "open-heart surgery in which a section of blood vessel is transplanted from the aorta into the coronary artery to bypass the blocked section of the coronary artery and improve blood supply to the heart.The pathophysiology of coronary artery disease was established by Adam Hammer in 1876 when he postulated that angina (imbalance in coronary blood flow supply and demand) was caused by an interruption in coronary blood supply and that myocardial infarction occurred after the occlusion of at least one coronary artery.(10) CABG medical procedure is in many cases thought about a high-risk methodology, related with a 30-day dreariness and death rate up to
14.0% and 2.0%, respectively.(11) Recently, there has been a boundless organization of early extubating and quick track conventions, which has brought about before clinic release, with a typical

post-operation length of stay of 4-5 days.(11) In spite of the fact that there has been a sensational lessening in heart mortality in the beyond twenty years, cardiovascular sickness stays the main enemy of all kinds of people in a large portion of the western world.(12) In Europe, this ailment represents 56% of passing's in ladies and 43% in men. Notwithstanding, ladies will generally be underrepresented in both planned and review investigations of helpful methodologies.(13) In any case, it is as yet an exceptionally perplexing a medical procedure and has been related with various complexities.(14) The complexities from this significant medical procedure can be grouped in different ways; some are devastating, like passing and stroke, while others can be self-restricting with next to no drawn-out leftover impacts, such as atelectasis, lower respiratory disease, or transient intense kidney injury.(15) Subsequently, in spite of the fact that ladies have some normal benefit over men, this is driven by age, and ladies do find men over their whole life expectancy.(16) Ladies are by and large more established than men at the hour of determination and have a higher weight of comorbidities.(17) Past examination has additionally recommended that the prescient worth of realized pre-employable gamble factors for early mortality after CABG differs among people. (18) According some studies, heart rate variability (HRV) decreases extensively in sufferers after coronary artery bypass grafting (CABG) surgical treatment, a circumstance that is even riskier than MI.(19)

The effect of stretching combined with deep breathing exercises on the cardiovascular system is not well recorded, and hardly any study has concentrated on blood pressure, diminishes in heart rate, and oxygen satiation. These substitutes are most influential for post-cardiac section cases the one are not only improving from the cardioplegia but more have changing capacity rank. This will possibly be the study at which point essential non-obtrusive hemodynamic limits are deliberate. Therefore, the accompanying study was being attended to decide the effect of the stretching technique combined with breathing exercises on oxygen satiation, ancestry pressure and heart rate after CABG

II. Materials and methods

This study was Randomized Controlled trial. The study was conducted on general population in District Head Quarter Hospital Layyah who fulfills the inclusion criteria. The study was completed within the time duration of six months after the approval of synopsis. Sample size is 24 using Epitool (6) Inclusion criteria were both male and female, 35-50 years' old, no DVT related emergency was seen before and after surgery and ability to follow study protocol. Non-probability convenient sampling method was used to recruit the things for the study. Data collection tools **were** Pulse oximetry and Sphygmomanometer BP apparatus.

The protocol of treatment was as follows: **Group A**, participants were given stretching technique with deep breathing exercises. Patient in Cardiac Rehabilitation phase 2 aimed at active range of motion which is beneficial in healing and in recovery from soft tissue and joint lesions, maintaining existing joint and soft tissue mobility, assisting neuromuscular reeducation and enhancing synovial movement. The session consisted of 3 stretches for 30 seconds at the maximum range of motion with a 30-second rest between sets and 1-minute rest between exercises. Each the training session lasted approximately 10 minutes and the Heart Rate and pulse rate will be recorded continuously. Stretch will have: 3 raps, 3 sets, 30 sec stretch hold. **Group B**, (controlled group) was given lifestyle change educational program, nutritional reeducation that focused to maintain a healthy weight to avoid putting undue strain on patient's heart and smoking cessation tactics. Pre-interventional readings were taken at baseline & post interventional readings at 6th week**.** Data was analyzed using statistical significance p=0.05 by a windows software SPSS, version 25. To check the normality of data Shapiro-Wilk Test was used. In Shapiro-wilk test p value was greater than 0.05, that's showed that data was normally distributed and parametric tests were used.

III. RESULTS:

A total number of 24 patients were selected in the respective research in which 12 were place in Group A and 12 were placed in Group B according to inclusion and exclusion criteria. The patients were taken the consent and given a time period of 5 minutes to warm up. Before starting the treatment blood pressure, oxygen saturation and heart rate were measured using pulse oximeter and sphygmomanometer was used. Group A was given mentioned stretching protocols. The session consisted of 3 stretches for 30 seconds at the maximum range of motion with a 30-second rest between sets and 1-minute rest between exercises. Each the training session lasted approximately 10 minutes and the Heart Rate and pulse rate will be recorded continuously. Stretch will have: 3 raps, 3 sets, 30 sec stretch hold. Group B was assigned with educational program that consisted of lifestyle changing educational program, nutritional reeducation and Smoking cessation tactics.

Data was analyzed using SPSS 21 frequency percentages, mean and standard deviation was assessed on demographics. Out of 24 patients in group A there were 4 females (33%) and 8 males (67%). And in Group B there were 8 females (67%) and 4 males (33%). The Mean and standard deviation of age in Group A (experimental group) was 40.83±3.25 and in controlled group was 40.83±3.65. In group A,

the patients mean BMI was 25.93 kg/m2 and in group B, mean BMI were 26.21 kg/m2. The Normality of the data was checked by Shapiro Wilk test that showed that data is normally distributed as shown by the p value. (p-value > 0.05= normal). Due to these results the parametric test was applied as independent t test between the group analysis and paired t test for within group analysis. Both groups had similar baseline treatment values for pulse oximeter, heart rate, and blood pressure, with p-values less than 0.05. Pre-treatment mean SD of pulse oximetry in stretching with deep breathing exercises is 84.00±1.26, while the baseline treatment is 85.66±2.16. Pre-treatment Stretching with deep breathing exercises has a mean SD of SBP of 150.83±2.48 while baseline treatment has a mean SD of 150.33±2.16. Pre-treatment mean SD of DBP in Stretching with Deep Breathing Exercises is 101.83±2.31, while the baseline treatment is 99.17±2.85. The pre-treatment mean heart rate in Stretching with deep breathing exercises is 91.17±3.31, while the baseline treatment is 89.66±3.77. The independent sample t-test was used to compare the oxygen saturation values before and after treatment in two groups. The results revealed a statistically significant difference between two groups (p 0.05). The pre-treatment mean SD of pulse oximetry in stretching with deep breathing exercises is 84.00±1.26%, while the baseline treatment is 85.66±2.16%. The mean SD of oxygen saturation in stretching with deep breathing exercises after treatment is 92.50±1.52 percent, while the baseline treatment is 88.50±1.97 percent. To compare pre-treatment and post-treatment SBP values between two groups, an independent sample t-test was used. The results revealed a statistically significant difference between two groups (p 0.05). SBP improved to greater extent in Stretching with deep breathing exercises with means value 140.50±2.88mmHg as compared to baseline treatment with mean 145.83±2.40mmHg. The independent sample t-test was used to compare DBP values before and after treatment in two groups. The findings revealed a statistically significant difference between two groups (p 0.05). DBP improved to greater extent in Stretching with deep breathing exercises group with means value 91.66±3.01mmHg as compared to baseline treatment group with mean 96.00±2.19mmHg. Independent sample t-test was applied to compare pre-treatment and post-treatment Heart rate between two groups. The results showed that there was statistically significant difference between two groups with $p < 0.05$. Pre-treatment mean value of heart rate in Stretching with deep breathing exercises is 91.17±3.31bpm while in baseline treatment is 89.66±3.77bpm. Post-treatment Mean±SD of Heart rate in Stretching with deep breathing exercises is 79.83±3.60bpm while in baseline treatment is 85.50±3.73bpm. The paired sample t-test was used to compare the oxygen saturation values within each treatment group in this table. The results showed statistically significant variation in both groups (p-value less than 0.05), with the stretching with deep breathing exercises group showing a greater difference. The paired sample t-test was used to compare the HR within each treatment group in this table. In group A combined stretching with deep breathing exercises pre-treatment Mean±SD of HR is 91.17±3.31bpm while in post-treatment is 79.83±3.60bpm. In baseline treatment, pre-treatment Mean±SD of HR is 89.66±3.77bpm while in post-treatment is 85.50±3.73bpm.

IV. DISSCUSION:

The primary goal of this study was to assess the effects of combined stretching technique and deep breathing exercise on O2 saturation, blood pressure, and heart rate in post-CABG patients. There was a randomized controlled trial. Group A stretched and did deep breathing exercises. The baseline therapy was given to Group B. SPSS 25 was used to analyze the data. With a p-value of 0.05, there was a statistically significant change in blood pressure, pulse oximetry, and heart rate within both groups. Both were effective, however stretching combined with deep breathing techniques resulted in greater improvement. Stretching combined with deep breathing exercises and baseline treatment were effective in reducing blood pressure, enhancing oxygen saturation, and lowering heart rate in CABG patients.

A Zarneshan et al performed a study to evaluate the effects of stretching combined with breathing exercise on hemodynamic and oxygenation changes in CABG patients. Based on the research findings, combined stretching-breathing exercise had a beneficial effect on improving heart rate and arterial blood oxygenation in CABG patients and this can speed patient recovery as a rehabilitation program.(20) Groupie conducted a study to evaluate the effect of muscle strength training on muscle strength, maximal oxygen uptake (VO2max), hemodynamic and anthropometric parameters as well as quality of life after coronary artery bypass grafting (CABG). The dynamic-resistance muscle strength training protocol using isokinetic dynamometer can safely (i.e. without clinical symptoms or changes to the ECG and arterial blood pressure) improve muscle strength and VO2max without any major risks in patients post-CABG.(21) A single center, prospective study carried out in Indian tertiary care set-up. The purpose of the study was to demonstrate the effect of chair aerobics as low intensity exercise training in heart rate, blood pressure and six-minute walk distance in post CABG patients during phase I cardiac rehabilitation Fifty patients post CABG patients were included. Chair aerobics as a low intensity exercise training was given. Pre and post-exercise outcome measurements in the form of heart rate, blood pressure and six-minute walk distance test were recorded. Chair aerobics as low intensity

exercise training demonstrated improvement in heart rate, systolic blood pressure and six minute walk distance test in subjects with CABG through phase I cardiac rehabilitation.(22) This has also been proved in present study as the subjects of both groups showed significant improvement in heart rate and blood pressure after receiving their respective interventions with more improvement in stretching with deep breathing exercises group. Results of study revealed that there is a significant decrease in systolic blood pressure, diastolic blood pressure and proteinuria in both groups A (stretching exercise) and B (autogenic training) after 6 weeks of treatment. There was no significant difference between both groups post-treatment in systolic blood pressure, diastolic blood pressure, and proteinuria. It can be concluded that both stretching exercise and autogenic training were found to be effective nonchemical methods which control the symptoms.(23) A Systematic Review and Meta-analysis was performed to show the effects of stretching on the responses of the cardiovascular system. Stretching significantly reduces arterial stiffness and HR. The qualitative description of the studies was also supported by the meta-analytic synthesis. No adverse effects were reported, after stretching, in patients affected by cardiovascular disease on blood pressure.(24) The current study found a statistically significant difference between two groups in terms of all outcome measures using the paired t test and the independent sample t test, with p-value 0.05. The group that did stretching and deep breathing exercises, on the other hand, improved more than the group that did the baseline treatment.

V. CONCLUSION:

The study concluded that stretching with deep breathing exercises and baseline treatment were useful in improving oxygen saturation, lowering blood pressure and heart rate among CABG patients. However, stretching with deep breathing exercises was more effective in terms of mentioned outcome measures based on their mean differences.

Acknowledgement:
All the authors have been informed of their inclusion and have approved this.

Disclaimer:
This research has not been presented or published in any conference or book.

Conflict of interest:
All authors have disclosed no conflicts of interest relevant to this paper.

Funding disclosure:
This research did not receive any specific grant from any funding agencies in the public, commercial, or non-profit sectors.

Table 1: Tests of Normality:

Tests of Normality

Variables	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Groups	.336	24	.000	.640	24	.000
Age in years	.146	24	.200*	.927	24	.082
Gender	.336	24	.000	.640	24	.000
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

Table 2: Between group analysis:

Oxygen Saturation (SpO_2)	**Stretching with deep breathing exercises (Mean±S.D) (n=12)**	**Control group (Mean ± S.D) (n=12)**	**P-value**
Pre- treatment	84.00±1.26	85.66±2.16	0.134
Post treatment	92.50±1.52	88.50±1.97	0.00
SBP (mmHg)			
Pre- treatment	150. 83±2.48	150.33±2.16	0.718

Post treatment	140.50±2.88	145.83±2.40	0.00
HR (bpm)			
Pre- treatment	91.17±3.31	89.66±3.77	0.481
Post treatment	79.83±3.60	85.50±3.73	0.02

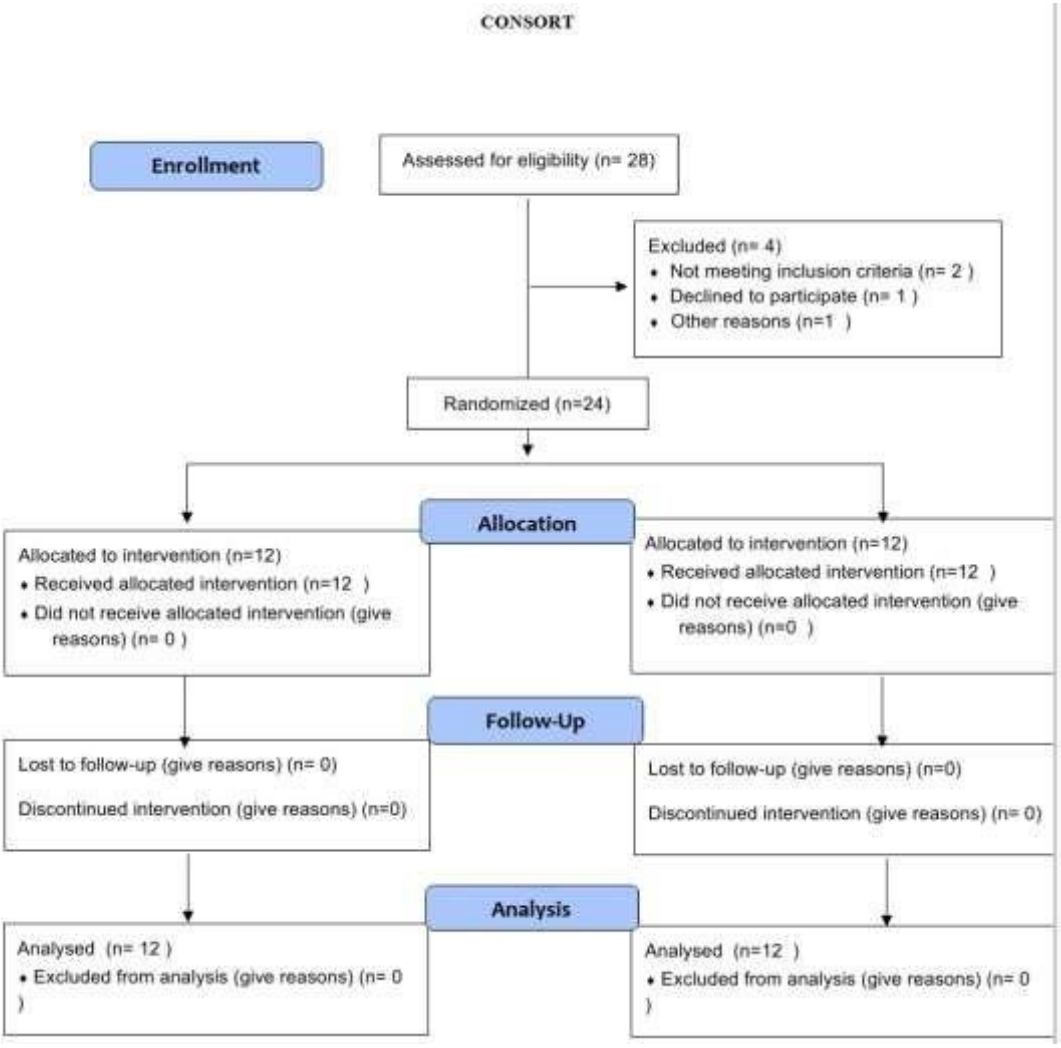

Fig: Consort flow chart:

References:

1. Shao C, Wang J, Tian J, Tang Y-d. Coronary artery disease: from mechanism to clinical practice. Coronary Artery Disease: Therapeutics and Drug Discovery. 2020:1-36.
2. Kandaswamy E, Zuo L. Recent advances in treatment of coronary artery disease: role of science and technology. International journal of molecular sciences. 2018;19(2):424.
3. Flora GD, Nayak MK. A brief review of cardiovascular diseases, associated risk factors and current treatment regimes. Current pharmaceutical design. 2019;25(38):4063-84.
4. Sayols-Baixeras S, Lluís-Ganella C, Lucas G, Elosua R. Pathogenesis of coronary artery disease: focus on genetic risk factors and identification of genetic variants. The application of clinical genetics. 2014;7:15.
5. Dai X, Wiernek S, Evans JP, Runge MS. Genetics of coronary artery disease and myocardial infarction. World journal of cardiology. 2016;8(1):1.
6. Aggarwal A, Srivastava S, Velmurugan M. Newer perspectives of coronary artery disease in young. World journal of cardiology. 2016;8(12):728.
7. Wong ND. Epidemiological studies of CHD and the evolution of preventive cardiology. Nature Reviews Cardiology. 2014;11(5):276-89.

8. Bachar BJ, Manna B. Coronary artery bypass graft. 2018.
9. Schumer EM, Chaney JH, Trivedi JR, Linsky PL, Williams ML, Slaughter MS, et al. Emergency coronary artery bypass grafting: indications and outcomes from 2003 through 2013. Texas Heart Institute Journal. 2016;43(3):214-9.
10. Diodato M, Chedrawy EG. Coronary artery bypass graft surgery: the past, present, and future of myocardial revascularisation. Surgery research and practice. 2014;2014:726158.
11. Hussain SMA, Harky A. Complications of coronary artery bypass grafting. International Journal of Medical Reviews. 2019;6(1):1-5.
12. Kurlansky P, Herbert M, Prince S, Mack M. Coronary bypass versus percutaneous intervention: sex matters. The impact of gender on long-term outcomes of coronary revascularization†. European Journal of Cardio-Thoracic Surgery. 2016;51(3):554-61.
13. Kurlansky P, Herbert M, Prince S, Mack MJ. Coronary Artery Revascularization Evaluation—A Multicenter Registry With Seven Years of Follow- Up. Journal of the American Heart Association. 2013;2(2):e000162.
14. Filardo G, Hamman BL, Pollock BD, da Graca B, Sass DM, Phan TK, et al. Excess short-term mortality in women after isolated coronary artery bypass graft surgery. Open Heart. 2016;3(1):e000386.
15. Ram E, Sternik L, Moshkovitz Y, Iakobishvili Z, Zuroff E, Peled Y, et al., editors. Coronary artery bypass grafting following acute coronary syndrome: impact of gender. Seminars in Thoracic and Cardiovascular Surgery; 2021: Elsevier.
16. den Ruijter HM, Haitjema S, van der Meer MG, van der Harst P, Rouleau JL, Asselbergs FW, et al. Long-term outcome in men and women after CABG; results from the IMAGINE trial. Atherosclerosis. 2015;241(1):284-8.
17. Kytö V, Sipilä J, Rautava P, Gunn J. Sex differences in outcomes following acute coronary syndrome treated with coronary artery bypass surgery. Heart, Lung and Circulation. 2021;30(1):100-7.
18. Peters SA, Kluin J. Why do women do worse after coronary artery bypass grafting? European Heart Journal. 2022;43(1):29-31.
19. Ghardashi-Afousi A, Holisaz MT, Shirvani H, Pishgoo B. The effects of low-volume high-intensity interval versus moderate intensity continuous training on heart rate variability, and hemodynamic and echocardiography indices in men after coronary artery bypass grafting: A randomized clinical trial study. ARYA Atheroscler. 2018;14(6):260-71.
20. Zarneshan A, Safaee N, Esmealy L, Esmealy B. Effects of Combined Stretching and Breathing Exercise on Hemodynamic and Oxygenation Changes in Patients Undergoing CABG Surgery. Journal of Health and Care. 2021;22(4):327-38.
21. Ghroubi S, Elleuch W, Abid L, Abdenadher M, Kammoun S, Elleuch M. Effects of a low-intensity dynamic-resistance training protocol using an isokinetic dynamometer on muscular strength and aerobic capacity after coronary artery bypass grafting. Annals of physical and rehabilitation medicine. 2013;56(2):85-101.
22. Thapa S, Pattanshetty RB. Effect of Chair aerobics as low intensity exercise training on heart rate, blood pressure and six minute walk distance in post coronary artery bypass graft surgery patients through phase I cardiac rehabilitation. Nepalese heart journal. 2016;13(1):19-23.
23. Awad MA, Hasanin ME, Taha MM, Gabr AA. Effect of stretching exercises versus autogenic training on preeclampsia. J Exerc Rehabil. 2019;15(1):109-13.
24. Thomas E, Bellafiore M, Gentile A, Paoli A, Palma A, Bianco A. Cardiovascular Responses to Muscle Stretching: A Systematic Review and Meta-analysis. International journal of sports medicine. 2021;42(6):481-93.