

Comparison of Cycling and Cross Trainer on Rate Pressure Product in Hypertensive Patients: A Cross-Sectional Study

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DOI: <https://doi.org/10.52403/ijshr.20240252>

ABSTRACT

Introduction: The Rate pressure product is the valuable marker of cardiac function. It is the product of heart rate and systolic blood pressure. It plays a pivotal role in understanding the relationship between exercise and the cardiovascular system, particularly in hypertensive individuals. Hypertension is a primary risk factor for coronary heart disease, stroke, congestive heart failure, renal failure and peripheral vascular disease. The aim of the study is to determine the effect of cycling and cross trainer on rate pressure product in hypertensive patients.

Methodology: A cross-sectional study includes 30 hypertensive patients with age group of 25-65 years and those who have any recent surgery or any neurological or psychological issues are excluded. Patients' vitals were monitored pre exercise. Every patient does exercise on both cross trainer and cycling for 15 min each on alternate day to avoid superimpose effect of each other. Rate pressure product was calculated and compared between cross trainer and cycling exercise.

Result: Result has been obtained from SPSS 20. Mean age of patients is 45.9 ± 10.2 . Comparison between cycling and cross trainer found using independent t-test ($t=2.534$). There was significant difference of RPP between patients performing cycling

and cross trainer. RPP of cross trainer (mean=19.09) is more than RPP of cycling (mean=18.14) having significant difference $p < 0.05$.

Conclusion: This study concluded that there is greater rate pressure product during cross trainer exercise than in cycling. This shows that more myocardial oxygen consumption is greater in cross trainer as it involves both upper and lower extremity. So, cross trainer and cycling can be used effectively for exercise prescription and preventing cardiovascular risk in hypertensive patients, but the cycling was more effective as the mean difference was low compared to cross trainer.

Keywords: Static cycling, rate pressure product, cross trainer, hypertension

INTRODUCTION

Hypertension is defined as systolic blood pressure above 140 mmHg and diastolic blood pressure above 90 mmHg.¹ It is the independent risk factors for various cardiovascular events such as haemorrhage, stroke, myocardial infarction and infraction of other organs as the high blood pressure leads to atherosclerosis due to accumulation of fat, cholesterol and other substance.²

RPP, a surrogate marker of myocardial oxygen demand, plays a pivotal role in assessing the cardiovascular response to exercise. Rate pressure product (RPP) is the

product of heart rate and systolic blood pressure that is maximum pressure exerted by the blood on the vessel walls. Rate pressure product is elevated during static or dynamic resistance or upper body work indicating increased myocardial oxygen demand.³

Hypertensive patients often benefit from regular aerobic exercise to improve cardiovascular health and investigating the impact of cycling and cross trainer exercises on RPP allows for a more understanding of how each modality influences myocardial oxygen demand. This knowledge can contribute to minimizing potential risks and ensuring the safety of exercise interventions. However the response of rate pressure product with cycling and cross trainer was not found yet so the need of the study is to determine the appropriate exercise prescription and prevention of cardiovascular risk in hypertensive patients in terms of rate pressure product and rate of perceived exertion.

So the aim of the study is to determine the effect of cycling and cross trainer on rate pressure product on hypertensive patients.

MATERIALS & METHODS

An observational study was conducted on 30 subjects with hypertension aged 25-65 years using random sampling. Participants with neurological and musculoskeletal conditions were excluded. Materials used in the study were cycling, cross trainer sphygmomanometer and pulse oximeter.

Prior consent was taken from each participant for participating in this study and they were explained about proposal and procedure of the study. Participants were asked to wear comfortable clothing and shoe for cycling and cross trainer and also not consume heavy diet, tea, coffee and any alcoholic substances.

Basic demographic details were taken. Participants were given rest for 5 min and then resting vitals were taken that includes Heart Rate, Blood Pressure, SPO₂ and Respiratory Rate. Each participant engages in 15-minute sessions of cross-training and cycling on alternating days, with the sequence randomized to prevent overlapping effect of each exercise.

Post exercise vitals were taken and Rate Pressure Product were calculated:

$$\text{Rate pressure product} = \text{heart rate (beats/min)} \times \text{systolic blood pressure (mmHg)} \div 1000$$

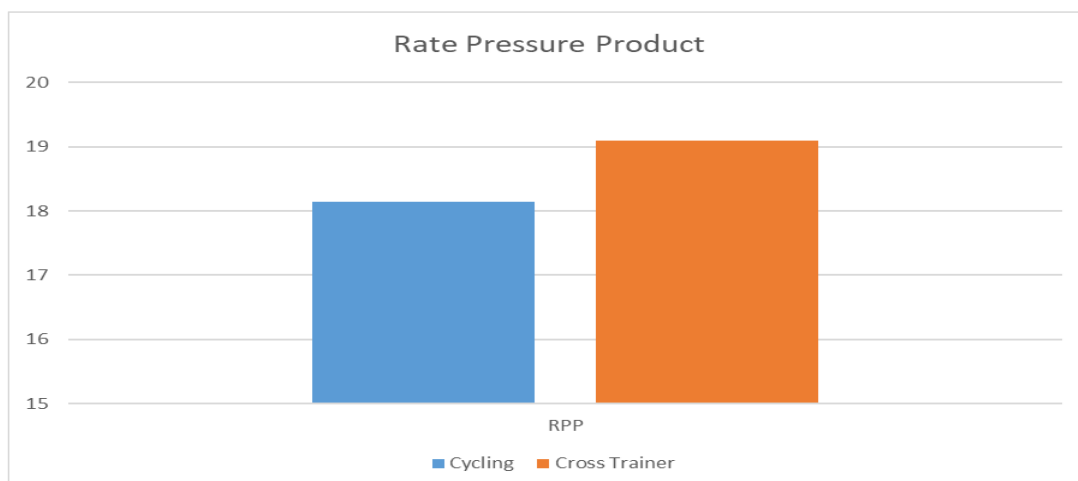
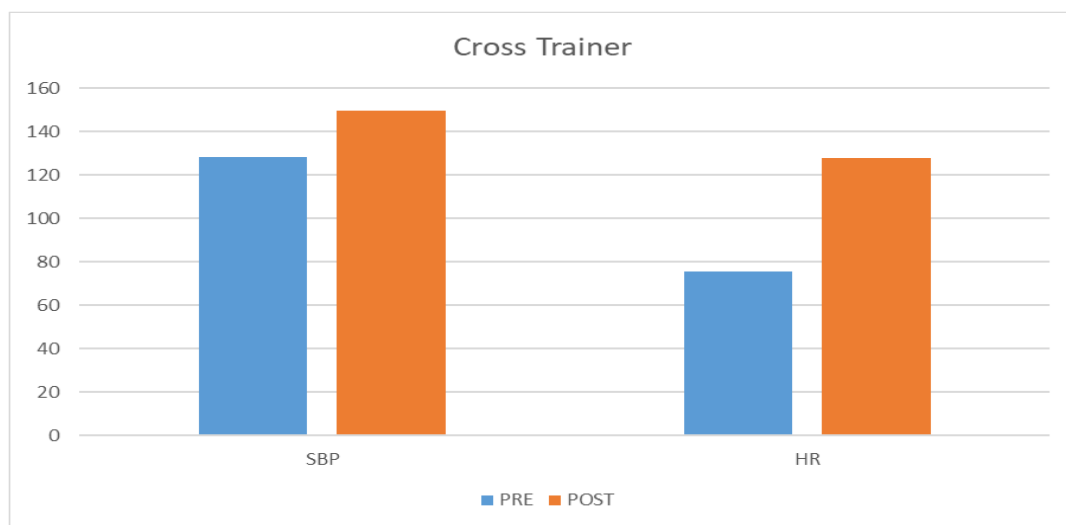
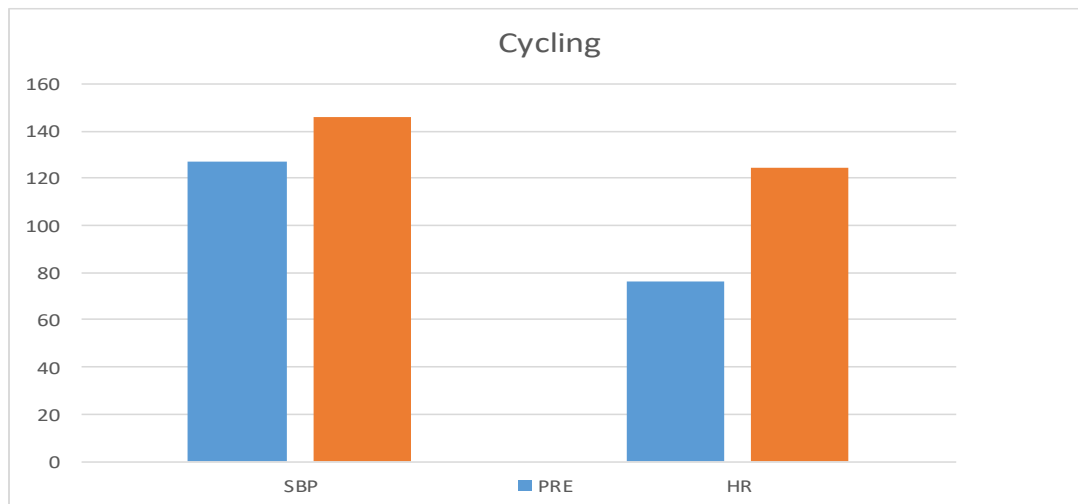
RESULT

Statistical analysis was done using SPSS version 20. Data was normally distributed checked by Shapiro Wilk Test.

To analyze the difference between cycling and cross trainer after 15 minutes of exercise, independent t-test ($t=-2.534$) was used where p value is < 0.05 , considered statistically significant.

Mean age, RPP of cross trainer and cycling is (45.9+10.2), (19.09+1.6) and (18.14+1.1) respectively.

Variables		SBP	HR	RPP
Cycling	Pre	127.2+6.3	76.4+7.4	9.7+1.1
	Post	145.8+1.7	124.5+8.5	18.1+1.1
Cross Trainer	Pre	128.2+6.6	75.3+7.5	9.6+1.1
	Post	149.5+9.5	127.6+9.3	19+1.6



DISCUSSION

The present study was conducted to see the effects of blood pressure and heart rate response (RPP) during cycling and cross training exercise. Result shows that both cycling and cross trainer was effective for

exercise prescription and preventing cardiovascular risk in hypertensive patients. Rate pressure product was higher in cross trainer compared to cycling so myocardial oxygen consumption was high in cross trainer. One possible explanation for the

observed difference in RPP values between cycling and cross trainer exercises could be the variation in cardiovascular demands imposed by each modality. While both activities are effective forms of aerobic exercise, the mechanics and muscle recruitment patterns differ between cycling and cross trainer workouts.

The cross trainer typically engages a wider range of muscle groups, including the upper and lower body, while cycling primarily targets the lower body muscles. As a result, the overall cardiovascular workload may be higher during cross trainer sessions, leading to elevated RPP values.

HR and SBP are the most important variables determining changes in myocardial oxygen consumption between rest and exercise⁴. There were significant increases in SBP, HR, and RPP with exercise, due to increases in sympathetic discharge⁵. HR, SBP, and RPP increase with increased workload on the heart to provide an adequate blood supply to the active myocardium during exercise.

Shivani Sutariya et al (2021) conducted a study on rate pressure product in hypertensive patients and shows the same result that treadmill was prone to be more effective as the mean difference was low compared to cross trainer and there was greater muscle fatigue noted with cross trainer.⁶

So, cross trainer and cycling can be used effectively for exercise prescription and preventing cardiovascular risk in hypertensive patients, but the cycling was more effective as the mean difference was low compared to cross trainer. Future research should be warranted to evaluate the long-term effects of cycling and cross trainer exercises on cardiovascular health outcomes such as dyspnea, fatigue and aerobic capacity in hypertensive populations.

CONCLUSION

This study concluded that there is greater rate pressure product during cross trainer exercise than in cycling, which shows that myocardial oxygen consumption is greater in cross trainer as it involves both upper and lower extremity.

Therefore, in patients with hypertension cycling is more beneficial than cross trainer.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Sweety Shah, Pankti Gajera. Comparison of cycling and cross trainer on rate pressure product in hypertensive patients: a cross-sectional study. *International Journal of Science & Healthcare Research*. 2024; 9(2): 405-408. DOI: <https://doi.org/10.52403/ijshr.20240252>
