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**Massey University**  
COLLEGE OF SCIENCES

**The effect of a cardiac rehabilitation programme on carotid stiffness and haemodynamic properties of patients diagnosed with a transient ischaemic attack: a pilot study**

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“I certify that all material in this research report which is not my own work has been identified and that no material is included for which a degree has previously been conferred upon me

.....”

Dr. James Faulkner  
Dr. Sally Lark

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**List of abbreviations**

ANOVA – Analysis of variance	FBG – Fasting blood glucose
ACE – Angiotensin-converting-enzyme inhibitors	HDL – High-density-lipoproteins
AII – Angiotensin II	HIIE – High-intensity intermittent exercise
ARB – Angiotensin receptor blockers	HR – Heart rate
AT <sub>1</sub> – Angiotensin type-1	HR <sub>max</sub> – Maximum heart rate
BF – Blood flow	IMT – Intima-media thickness
BFV – Blood flow velocity	LDL – Low-density-lipoproteins
BFV <sub>mean</sub> – Mean blood flow velocity	LTPA – Leisure-time physical activity
BFV <sub>max</sub> – Maximum blood flow velocity	NO – Nitric oxide
BL – Baseline	PI – Post-intervention
BMI – Body mass index	PP – Pulse pressure
BP – Blood pressure	PW – Pulse wave
BRS – Baroreflex sensitivity	PWV – Pulse wave velocity
Ca <sup>2+</sup> – Calcium	Q̇ – Cardiac output
CAD – Coronary artery disease	RAAS – Renin-angiotensin-aldosterone system
CC – Compliance coefficient	RPE – Ratings of perceived exertion
CCA – Common carotid artery	SAC – Systemic arterial compliance
CON – Control	SBP – Systolic blood pressure
CR – Cardiac rehabilitation	StiffINX – Stiffness index $\beta$
DBP – Diastolic blood pressure	SV – Stroke volume
DC – Distensibility coefficient	TC – Total cholesterol
ECG - Electrocardiogram	TIA – Transient ischaemic attack
eNOS – Endothelial nitric oxide synthase	VO <sub>2max</sub> – Maximal oxygen uptake
EX – Exercise	VO <sub>2peak</sub> – Peak oxygen uptake

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**Abstract**

Arterial stiffness is associated with cardiovascular risk factors (e.g., hypertension, abnormal blood lipids and lipoproteins, physical inactivity and obesity) and the existence of atherosclerosis, and is identified as an independent risk factor for coronary artery disease and ischaemic stroke. The common carotid artery is the major conduit supplying blood to the brain is of particular interest. Research has demonstrated that interventions, which target the aforementioned risk factors, reduce the risk of occurring vascular events. The aims of this study were to 1) identify whether an 8-week cardiac rehabilitation programme reduces the stiffness of the common carotid artery, as determined by changes in arterial compliance, distensibility and stiffness index  $\beta$ , in transient ischaemic attack (TIA), and; 2) investigate the relationship between changes to arterial stiffness and haemodynamic properties of the common carotid artery. Eighteen male and female participants (mean  $\pm$  SD; 65  $\pm$  11 y, 1.72  $\pm$  0.07 m, 85.6  $\pm$  11.5 kg) recruited within a 14 day period following a TIA, volunteered to take part in the present study. Initial risk stratification assessments (i.e., cholesterol, glucose, ECG, etc) were completed prior to assessing arterial stiffness and haemodynamic properties. An ultrasound device was used to obtain arterial measures while participants were rested and in a supine position. Participants were then randomised to either an exercise (EX; 8-week intervention), or to a usual-care control (CON) condition. Identical vascular measures were obtained post-intervention. Results revealed a significant Test by Condition interaction for arterial compliance, distensibility and stiffness index  $\beta$ , and for compliance and distensibility following the 8-week exercise intervention (all  $P < 0.05$ ). Post-hoc analysis demonstrated a significantly greater change in compliance and distensibility for the EX condition. No significant changes were observed in arterial haemodynamic properties or CAD risk stratification measures. The present study has demonstrated that exercise leads to improved

vascular health, as determined by a decrease in arterial stiffness, thus potentially leading to a reduced risk of an ensuing or recurring cardio- or cerebrovascular event.