



Walking Pace Induced Cardiovascular Recovery in School Sport- Aversive Students: Role of Gender

Mayowa Jeremiah Adeniyi^{1*}, Anna Chika Idaguko²

¹Departments of Physiology, Federal University Health Sciences Otukpo, Nigeria

²Department of Anatomy, Edo State University Uzairue, Edo State, Nigeria

Abstract: The importance of School sporting activities on psychomotor, cognitive and overall health of students has been documented. The aim of the study was to investigate the gender influence of walking pace on cardiovascular recovery in school sport aversive students. 30 students that consisted of 16 males and 14 females were recruited for the study using respondent driven sampling out of a pool of 50 students after satisfying the inclusion criteria. They were made to walk through the treadmill at 2.7km/h (low walking pace), 4.4 km/h (medium walking pace) and 5.5km/h (high walking pace) for 3 minutes. Blood pressure, pulse rate and SP02 were measured before, immediately after and 1 minute post recovery. High walking pace induced recovery systolic blood pressure was significantly elevated in females when compared to male. Recovery diastolic blood pressure, recovery mean arterial blood pressure (MABP), recovery pulse pressure and recovery pulse rate were higher at high walking pace in females than males. Under high, medium and low walking paces, shock index and pulse rate were elevated in females than males. In conclusion, school sport aversive females showed lower cardiovascular recovery than their male counterparts.

Keywords: Walking Pace, Cardiovascular Recovery, School sport, Pulse Rate, Blood Pressure.

Research Paper
<p>*Corresponding Author: <i>Mayowa Jeremiah Adeniyi</i> Departments of Physiology, Federal University Health Sciences Otukpo, Nigeria</p>
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INTRODUCTION

School sport programs are physical events designed to elicit positive physical, mental and emotional behaviours in students. They contribute strongly to development of gross and fine motor skills. They are also known to improve academic performance of students. Bolarinwa, (2020) investigated the effect of sport on academic performances of students in Ekiti State, Nigeria. The findings of the study indicated significant improvements in grade levels of secondary school students. Alasinrin and Ajeigbe, (2021) examined how students' participations in sport at tertiary level affect their academic performances in Nigeria. The authors highlighted the need for tertiary institution students to be encouraged to participate more actively in school sport.

In Morogoro Urban District Secondary Schools, a study was conducted by George and Benedicto, (2020) to evaluate the opinion of students on the impacts of school sports on academic performance. Most of the students had inconclusive view on whether

sport participation would positively influence academic performance. A study by Pinto-Escalona *et al.*, (2022) investigated whether participation in school sport at elite class would affect academic performance. It was reported that young elite athletes achieved a lower academic performance than their non-elite peers regardless of their type of sport.

Furthermore, physical activities exert profound influences on indices of physical fitness and wellness. Exercise is known to enhance mitochondrial function and vasculature as well as improve the release of myokines from skeletal muscle for enhancing cardiovascular function (Pinckard *et al.*, 2019; Adeniyi *et al.*, 2023; Awosika *et al.*, 2023). Young athletes who trained for 620 minutes/week were reported to exhibit enhanced physical fitness performances, lower relative body fat mass and higher relative skeletal muscle mass (Granacher *et al.*, 2017; Adeniyi *et al.*, 2023). There was a positive correlation between baroreflex sensitivity and double product and a negative correlation between peripheral oxygen saturation and baroreflex sensitivity in mildly active students (Adeniyi *et al.*, 2022).

Participants who were moderately or highly active accumulated more moderate-to-vigorous physical activity when compared to sedentary people with body mass index correlating negatively with moderate-to-vigorous physical activity (Oyeyemi and Adeyemi, 2013; Adeniyi *et al.*, 2020; Awosika *et al.*, 2022). A positive correlation was reported between shock index and alpha wave amplitude in males during post-exercise orthostasis (Adeniyi and Awosika, 2023).

Post exercise cardiovascular recovery, most especially heart rate recovery is an important indication of health and deranged heart rate recovery is a predictor of mortality. In a study by Jolly *et al.*, (2012), patients that had abnormal heart rate recovery at baseline who were able to normalize their heart rate recovery with exercise exhibited mortality similar to that of individuals with baseline normal heart rate recovery. Throughout the 1st to 5th min post exercise, heart rate recovery was shown to correlate positively with autonomic parasympathetic responsiveness (Ankita and Kirti, 2022). Lower heart rate recovery measured by treadmill stress test was reported to have a predictive value for the prognosis of IgA nephropathy (Sági, *et al.*, 2021; Adeniyi *et al.*, 2023).

Gender in general consensus plays significant roles in physiological responses to exercise and recovery. Fomin *et al.*, (2012) examined gender related responses in trained people to exercise. Although maximum heart rate, metabolic responses and respiratory quotient were the same in both males and females, cardiac index at maximum exercise was lower in females than in males. The aim of the study was to determine the role of gender in walking pace induced cardiovascular recovery.

METHODOLOGY

Study Design

The study was conducted in the Department of Physiology, College of Medical Sciences, Edo State University Uzairue, situated in Etsako West Local Government Area of Edo State, Nigeria.

Participants

30 apparently healthy young adult individuals averaging 18.3 years old were deployed for the study out of a pool of 50 participants. They consisted of 16 males and 14 females. Ethical clearance was obtained from the Ethical Committee, Edo State University Iyamho. Written consent was obtained from each subject and a well-structured questionnaire was administered to rule out those with medical history of musculoskeletal, respiratory, cardiovascular, kidney, hepatic and metabolic diseases or anatomical deformities as well as to participation in school game. History of smoking, alcoholism and caffeine and any form of medication was also taken.

Participants who signified interests or participated in any school sporting activities were ruled out.

Experimental Protocol

The study was done in the Physiology Laboratory at a temperature of 25°C between 8.00 a.m. and 10.00am for three consecutive days.

The treadmill was calibrated according to the Bruce Treadmill Protocol (Bruce *et al.*, 1963) as previously reported (Adeniyi *et al.*, 2022). The study proceeded as follows:

- i. Baseline Measurement; Subjects were asked to sit comfortably for 30 minutes. Cardiovascular and peripheral oxygen saturation (SP02) were measured.
- ii. Low walking pace; Sequel after baseline measurements were made, participants were asked to walk on a treadmill at a speed of 2.7km/h at an inclination of 10° for 3 minutes.
- iii. Medium walking pace; a day after low walking pace study, participants were asked to walk on a treadmill at a speed of 4.4km/h at an inclination of 10° for 3 minutes.
- iv. High walking pace; a day after medium walking pace, participants were asked to walk on a treadmill at a speed of 5.5km/h at an inclination of 10° for 3 minutes.

Measurement of Blood Pressure

Blood pressure was measured from the arm, an inch above the elbow using Omron BP7000 Evolve Wireless Upper Arm Sphygmomanometer (Iris Global Care, China). Baseline readings were taken at sitting position as previously reported (Oni and Adeniyi, 2017; Okeke *et al.*, 2023). Blood pressure measurements were also obtained for each of the legs at the first perception of exertion.

Pulse pressure was determined by subtracting diastolic blood pressure from systolic blood pressure.

Mean arterial blood pressure was obtained using; diastolic blood pressure +1/3 of pulse pressure.

Determination of Peripheral Oxygen Saturation

Peripheral oxygen saturation was measured using digital Pulse Oximeter MD300C25, Columbia, SC 29223.

Statistical Analysis

Statistical analysis was conducted using Statistical Package for Social Science Students (SPSS) 23. Statistical test was done using Analysis of Variance (ANOVA) and student t test. Statistically significant difference was accepted at P<0.05.

RESULTS

Systolic Blood Pressure

Figure 1 showed that female high pace recovery group exhibited higher systolic blood pressure

when compared with males. When compared with baseline, in females, low pace, medium pace, high pace, medium pace recovery and high pace recovery groups caused higher systolic blood pressure.

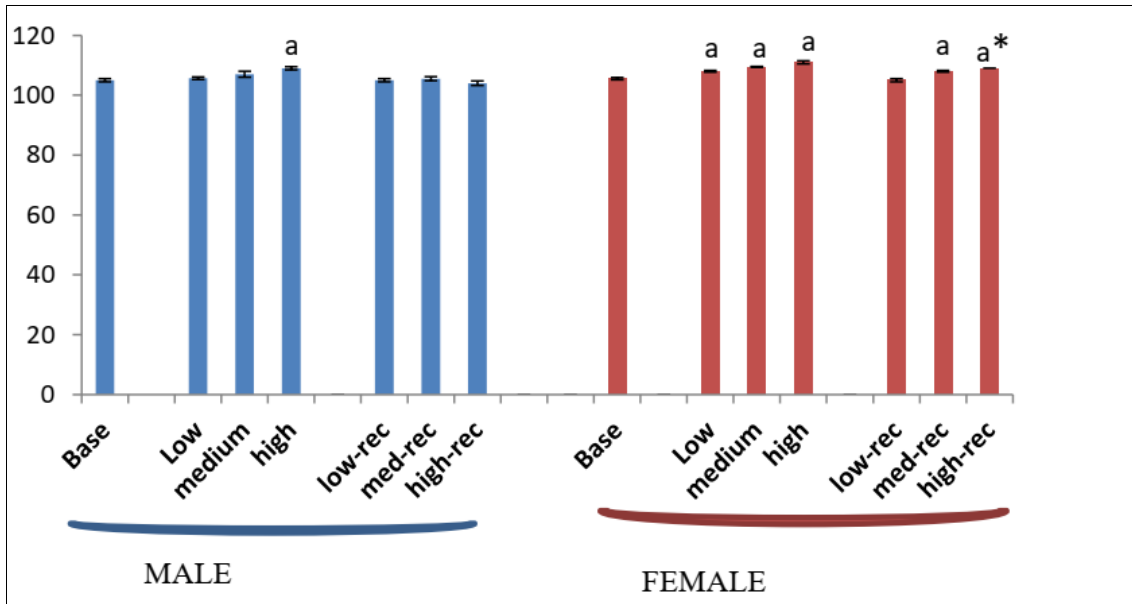


Figure 1: Effect of gender on pace induced systolic blood pressure recovery in school sport-averse students. ^a represent significant difference from male gender and baseline respectively

Diastolic Blood Pressure

Figure 2 showed that high pace group exhibited a higher diastolic blood pressure in female

when compared with male. High pace recovery group had higher diastolic blood pressure in females when compared with males.

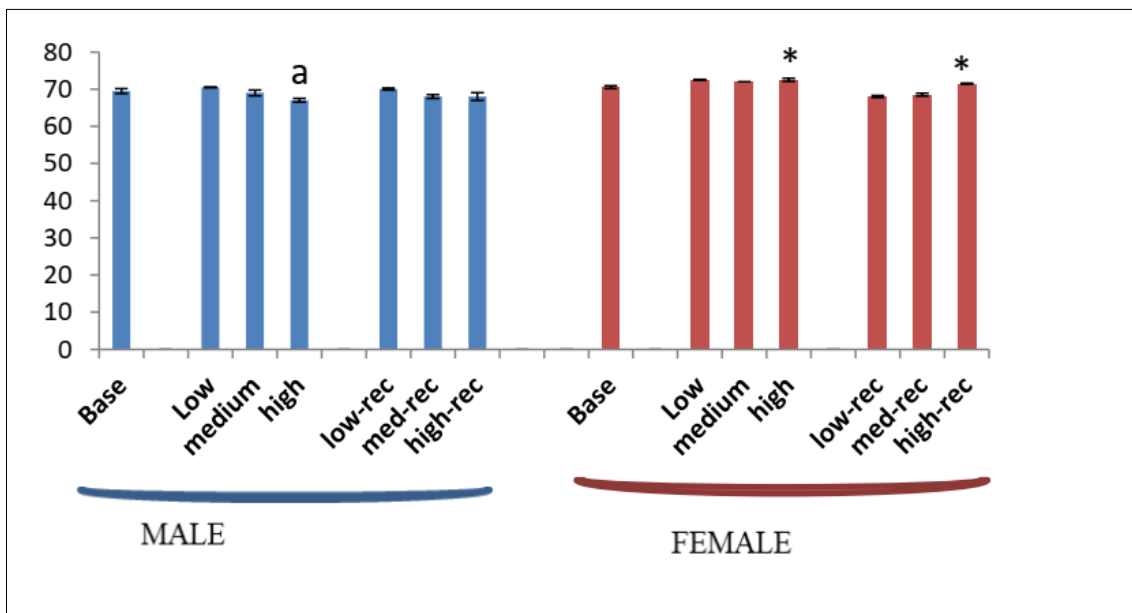


Figure 2: Effect of gender on pace induced diastolic blood pressure recovery in school sport-averse students. ^a represent significant difference from male gender and baseline respectively

Pulse Rate

Figure 3 showed that low pace, medium pace, high pace, low pace recovery, medium pace recovery and high pace recovery groups exhibited higher pulse

rate in females when compared with males. In females, low pace, medium pace, high pace, low pace recovery, medium pace recovery and high pace recovery group have higher pulse rate when compared with baseline.

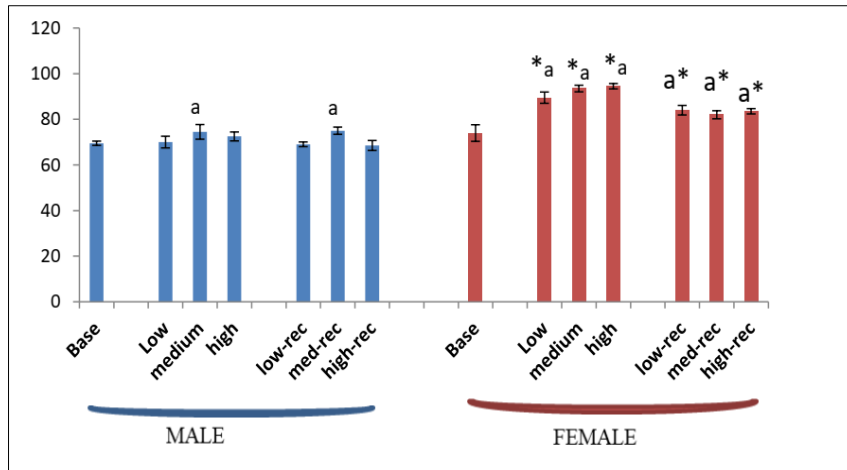


Figure 3: Effect of gender on pace induced pulse rate recovery in school sport-averse students *a represent significant difference from male gender and baseline respectively

SP02: Figure 4 showed that there was no gender based difference in SPO2 when males are compared with females.

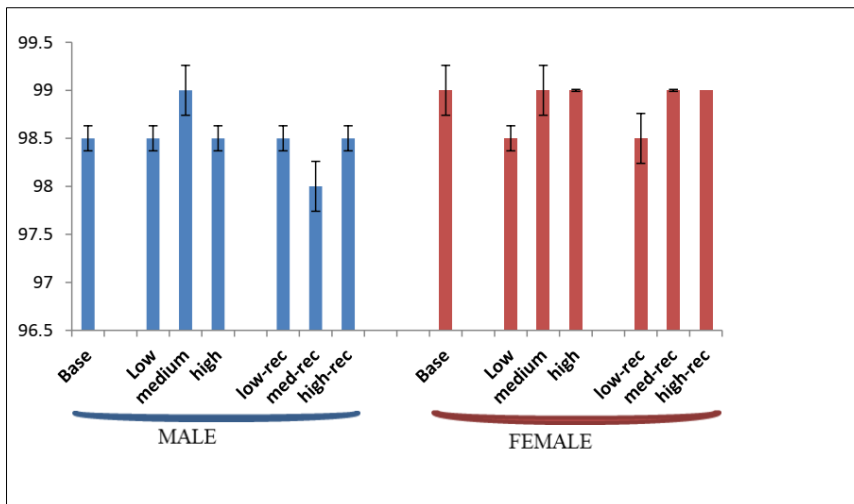


Figure 4: Effect of gender on pace induced SPO2 recovery in school sport-averse students

Mean Arterial Blood Pressure

Figure 5 showed that high pace and high pace recovery groups exhibited higher mean arterial blood pressure in females when compared with males.

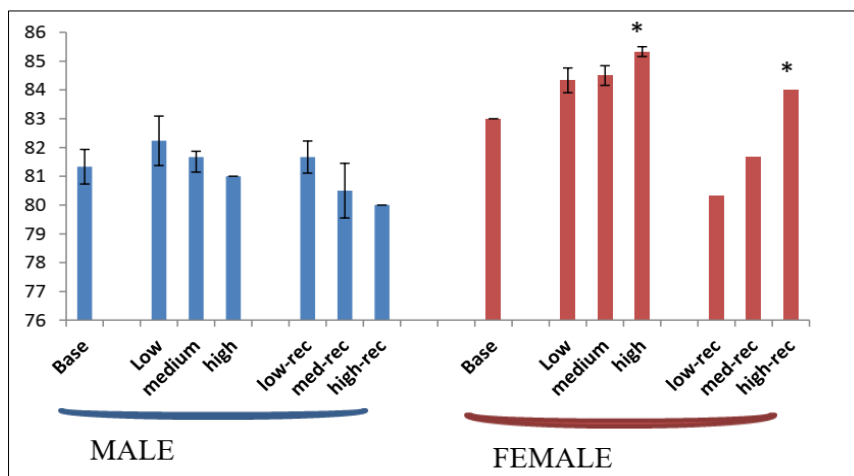


Figure 5: Effect of gender on pace induced MABP recovery in school sport-averse students

Shock Index

Figure 6 showed that low pace, medium pace, high pace, low pace recovery, and medium pace recovery groups exhibited higher shock index in

females when compared with males. In females, low pace, medium pace, high pace, low pace recovery and medium pace recovery groups have higher shock index when compared with baseline.

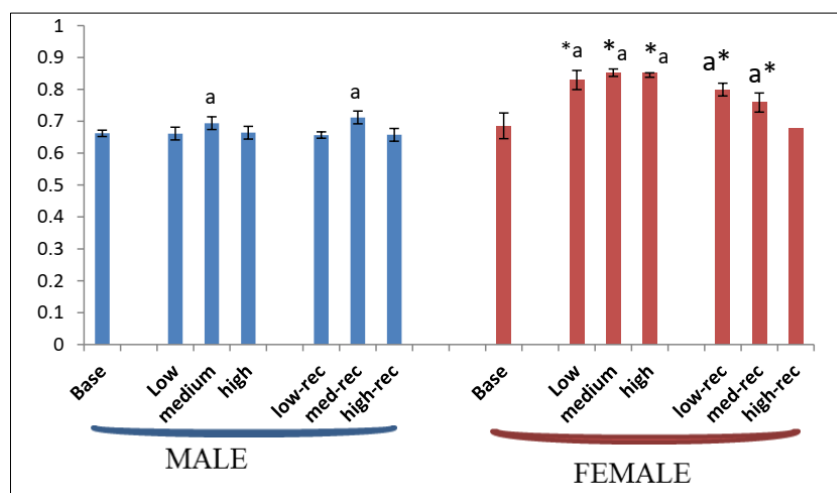


Figure 6: Effect of gender on pace induced shock index recovery in school sport-averse students *a represent significant difference from male gender and baseline respectively

Pulse Pressure: High pace recovery group exhibited higher pulse pressure pulse pressure in females when compared with males.

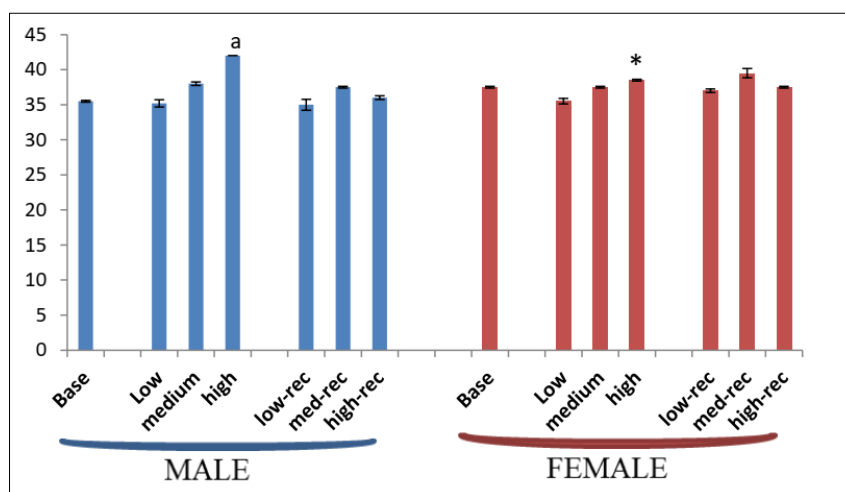


Figure 7: Effect of gender on pace induced shock index recovery in school sport-averse students *a represent significant difference from male gender and baseline respectively

DISCUSSION AND CONCLUSION

Walking is a physical activity and thus elicits increase in metabolic rate (Okeke and Adeniyi, 2021; Awosika *et al.*, 2022). The pace at which walking is done determines how much metabolic rate increases. Higher walking pace is believed to improve lifespan expectancy. Despite the incontrovertibility regarding the relevance of exercise in health maintenance and wellness, there is need for more orientation and public awareness about work-out design and plans to optimize health especially in school students who are a sedentary risk group (Uzochukwu *et al.*, 2023; Adeniyi *et al.*, 2023). The essence of the study was to understand

cardiovascular recovery effect of low, medium or high walking space in school sport-averse student and the possible roles played by gender.

Evident from the study are cardiovascular changes induced by different walking paces. In the study, systolic and diastolic blood pressure, pulse rate, mean arterial blood pressure, pulse pressure, shock index and peripheral oxygen saturation were unaffected in male students at a low walking pace (2.7km/h) relative to baseline. Since cardiovascular and respiratory indices change with metabolic demand, the result may imply that walking pace induced metabolic change was not sufficient enough to elicit rise in

cardiovascular indices and peripheral oxygen saturation. Conversely, in females, systolic blood pressure, pulse rate and shock index were higher at low walking pace when compared with baseline. This trend was supported by a Taiwanese study of 211 females and 89 males; low walking pace was reported to be associated with raised cardiovascular parameters and increased risk of cardiovascular diseases at middle aged (Yu-Lin *et al.*, 2020).

Hence, low walking pace is expected to activate muscle pumps to a lower extent. A Taiwanese study of 211 females and 89 males indicated that low walking pace was associated with increased risk of cardiovascular diseases at middle aged (Yu-Lin *et al.*, 2020).

Furthermore, when compared with males, low walking pace, medium walking pace and high walking pace caused higher pulse rate and shock index in females. Also, high walking pace caused higher diastolic blood pressure and pulse pressure in females than males. This may be due to gender related discrepancy in baroreflex sensitivity. Baroreflex sensitivity, heart rate response to blood pressure changes, plays role in cardiovascular regulation. Females are known to exhibit lower baroreflex sensitivity than males. Apart from baroreflex, muscle pumps are critical determinants of venous return and blood circulation (Casey and Hart, 2008) and females are known to have lower muscle mass than males.

Cardiovascular recovery is the tendency of indices of cardiovascular function to tend toward baseline at least 1 minute after cessation of stress (Yordi *et al.*, 2018). In the study, high pace recovery and medium pace recovery groups exhibited higher systolic blood pressure, pulse rate and shock index in female when compared to males. In females, low pace recovery group also showed elevated pulse rate and shock index when compared to males.

Cardiovascular recovery is an important indication of health and its derangement is a predictor of mortality (Sági, *et al.*, 2021). 1st to 5th min after exercise, heart rate recovery was shown to correlate positively with autonomic parasympathetic responsiveness (Ankita and Kirti, 2022). Patients with abnormal heart rate recovery at baseline who were able to normalize their heart rate recovery with exercise showed mortality similar to that of individuals with baseline normal heart rate recovery (Jolly *et al.*, 2012). When compared to untrained athletes, Dupuy *et al.*, (2022) reported an autonomic parasympathetic reactivation and a post-exercise heart rate recovery in trained adult endurance athletes.

The major finding of the study was that school sport averse females had lower recovery indices of cardiovascular function than school sport averse males.

This is evidenced by higher systolic blood pressure, pulse rate and shock index in female when compared to males in high and medium pace recovery groups as well as elevated pulse rate and shock index in low pace recovery group.

In conclusion, school sport averse females showed lower cardiovascular recovery than their male counterparts.

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