The Effect of Age on Mechanisms of Exercise Tolerance in Women

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Introduction

- Exercise Tolerance (ET) is the ability to carry out strenuous activity facilitated by dynamic skeletal muscle movements.
- It is a key clinical diagnostic and prognostic tool in cardiovascular health and disease.
- ET, as measured by peak oxygen consumption (VO_2 max), is determined by the following Fick equation

$VO_{2\ MAX}$ = Cardiac Output x Arteriovenous Oxygen Difference

Where:

Cardiac Output = Heart rate x Stroke Volume

- The Cardiovascular system undergoes several changes with aging that limit exercise and normal physiology.

Aim

- To define the specific mechanisms limiting Exercise tolerance in women with aging.

Methods

- 40 healthy women were recruited for this study; 20 young (aged 21-30 years) and 20 elderly women (aged 63-81 years).
- All subjects underwent comprehensive screening to ensure they had no history of cardiovascular or chronic pulmonary disease.
- Screening was also carried out to ensure none of the participants were on any medication known to limit or enhance cardiovascular function.
- All subjects carried out graded cardiopulmonary exercise testing with a bicycle ergometer. They also underwent non – invasive gas exchange and central haemodynamic measurements with the bio reactance method. (Figure 1)
- Online expired gas was measured to determine peak O_2 consumption along with a 12 lead ECG and non-invasive blood pressure monitoring.
- Pearson's coefficient of correlation (r) was used to evaluate the relationship between exercise tolerance and its components within and across the two age groups.

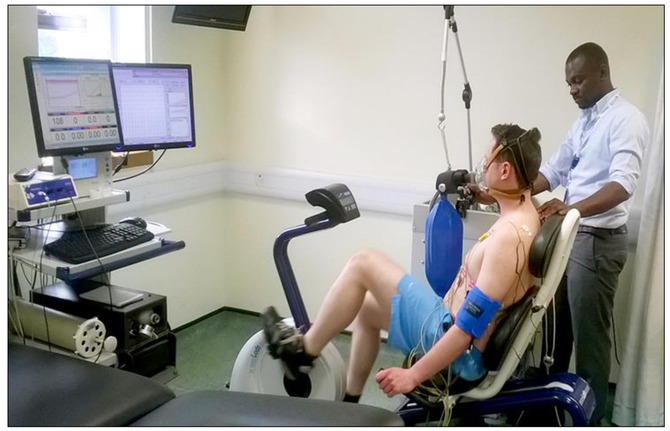

Figure 1- showing a subject carrying out an exercise test.

Results

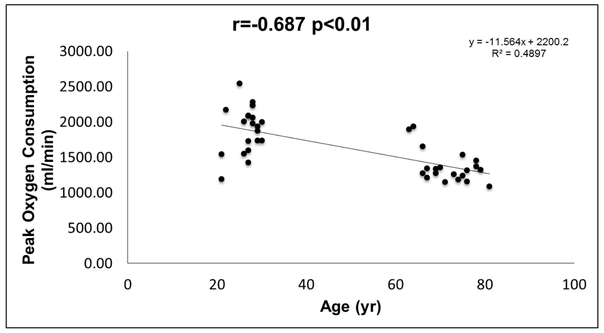

Figure 2 - showing the decline in peak oxygen consumption with increasing age during exercise across all 40 women.

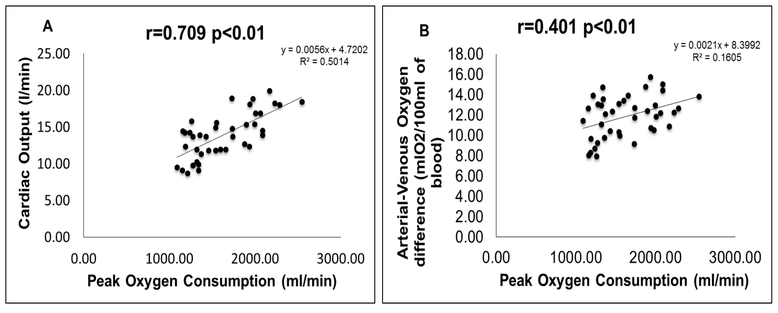

Figure 3 - Relationship between peak oxygen consumption and cardiac output (**A**) and arterial-venous oxygen difference (**B**) across all 40 subjects.

Discussion

- ✓ This study showed that there was a large decline in exercise tolerance with increasing age and this supports findings from previous studies. (Figure 2)
- ✓ There are also differences in the mechanisms underlying exercise capacity in young and older women. (Table 1)

	Peak O_2 Consumption (ml/min) ~ Cardiac Output (l/min)			Peak O_2 Consumption (ml/min) ~ Arterial-Venous O_2 difference (ml)		
	r	R^2	p	r	R^2	p
Young	0.657	0.432	0.002	0.456	0.208	0.043
Old	0.280	0.078	0.232	0.470	0.221	0.037

Table 1 - Relationship between Exercise tolerance and Cardiac Output/Arterial-Venous O_2 difference in the two age groups. (significance **p<0.05**)

- ✓ This suggests that a reduced cardiac output response to exercising muscles was the major limiting factor to ET in old age.
- ✓ It should be noted that the findings are limited to female participants and as physiological responses to exercise differ with gender, the results may not hold true for male subjects.

Conclusion

- Clinically, it is important further studies focus on interventions that will improve cardiac performance in the elderly population. This will ensure their quality of life and ability to perform aerobic tasks are not threatened.

Acknowledgements

- I would like to thank my Supervisor Dr Djordje as well as the whole of MoveLab for supporting me throughout this placement with them.
- I would also like to thank Newcastle University for awarding me the research scholarship to undertake this project.

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