Pilot Study to Characterise Ventilatory Constraints During Swimming

INTRODUCTION

For dry land sports such as cycling and running, there is existing research characterising the breathing patterns, operating lung volumes and EFL of athletes [1,2]. Nothing of the sort exists for swimming athletes, for whom breathing is less spontaneous due to the nature of the sport.

By undertaking testing in this area it may be possible to identify breathing constraints, or limitations in certain postures within the water. If such limitations are identified, this could influence the impact these have on performance enabling future research to explore how this can be manipulated for performance enhancement.

AIMS

There were two aims of this study:

1. to understand how breathing patterns and lung volumes of competitive swimmers differ (if at all) at rest, both on land and in water, laying horizontal and seated upright. This was done by comparing measures of the maximum amount of air the participant could breathe in and out in the situations described above.
2. to characterise breathing pattern and operating lung volumes while swimming at increasing intensities and to also identify what if any breathing constraint that may occur.

METHODOLOGY

Key
MEP = Maximal Expiratory Pressure
MIP = Maximal Inspiratory Pressure
MVFL = Maximum Flow Volume Loop
IC = Inspiratory Capacity

Anthropmetric data collected
- Height
- Weight

MEP / MIP data collected

On land

Upright Data
- MFVL
- IC

Supine Data
- MFVL
- IC

In water

Upright Data
- MFVL
- IC

Supine Data
- MFVL
- IC

IC Data – Incremental step test
80% of 400m PB – IC at 3&4 mins
85% of 400m PB – IC at 8&9 mins
90% of 400m PB – IC at 13&14 mins
95% of 400m PB – IC at 18&19 mins
100% of 400m PB – IC at 23&24 min

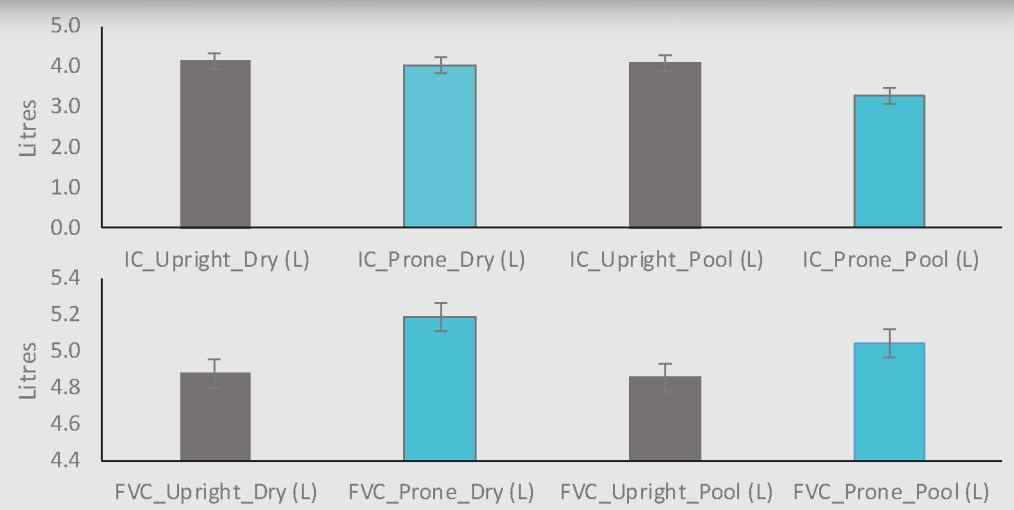
MEP / MIP data collected

RESULTS

Testing involved four participants made up as two male and two female. Ages varied from 16 to 52 and all athletes were swimmers with at least 1 year history of competing and undertook regular swim training.

The results show the mean average of inspiratory capacity (IC) at rest when upright and submerged in water is identical to the same measure out of water, at 4.1 L ±0.9. Inspiratory capacity when laying face down (prone) at rest and on land returned a similar result at 4 L ±0.9, while capacity when prone in water was less than other measures at 3.3 L ±0.8.

Force Vital Capacity (FVC) again returned identical results when upright on dry land and also in water at 4.9 L ±1.1 and 4.9 L ±1.0 respectively. FVC when laying face down returned results displaying a higher FVC at 5.2 L ±1.2 on land when compared with 5.0 L ±1.2 in water.



Figures: Comparing the mean average inspiratory capacity and force volume capacity

CONCLUSION

With both IC and FVC results show when in an upright position at rest, both in water and out of water, there was very little, if any, difference. However, when comparing this with IC and FVC laying face down at rest both in and out of water, both measurements show a decrease in capacity. As swimming is a horizontal sport this is relevant as this indicates a possibility that during swimming there is a reduced capacity to breathe oxygen in and out. As oxygen is the fuel for aerobic muscle activity and a small contribution to anaerobic activity, this may present a barrier as to how much energy a swimmer can exert during a competition..

A limitation of this study is the number of participants used and a greater sample is needed to draw any firm conclusions.

RECOMMENDATIONS

Further research is needed into whether these results are replicated during swimming activity and if so whether a swimmer can do anything to increase their IC and FVC i.e. improve lung function, to see if this ultimately impacts performance.

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REFERENCES:

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Student: Jennie Scrimshaw

Supervisor: Danny Taylor