



Memory and the Dive Response

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Introduction

The Royal National Lifeboat Institution (RNLI) released a TV advert entitled “Float to Live” as part of its ongoing “Respect the Water” campaign in 2017. The RNLI advises people who accidentally fall into cold water to fight against their natural instincts, remain calm and simply float to live. This advice prompted us to investigate the dive response.

The dive response is a mammalian response to cold water which redirects blood away from normal body functions and towards the vital organs as a means of survival. After investigating this, we wondered whether a person undergoing the dive response, having fallen into cold water may have impaired memory recall and be unable to recall the life-saving information provided by the RNLI.

Aim of Our Study

The aim of this study is to investigate whether the dive response has an effect on memory. We hypothesised that the induction of the dive response may impair one’s memory.

How Can We Induce The Dive Response?

The dive response is naturally induced when the skin on the face comes in contact with cold water and breath is being held. This is sensed by the trigeminal nerves (Figure 2). We can induce the dive response by placing a cold, damp face cloth on a participant’s face while they hold their breath for 30 seconds (Figure 3). This results in decreased heart rate and increased blood pressure.

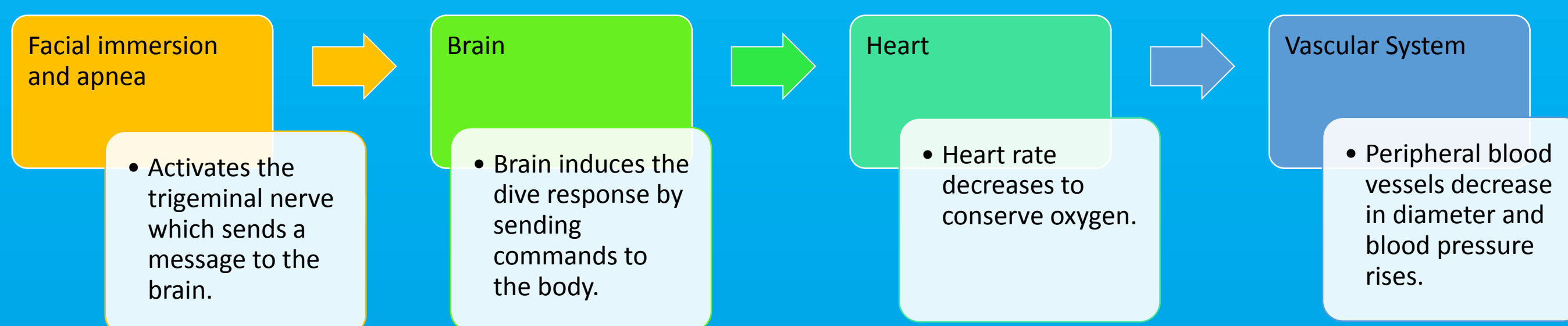


Figure 1: Schematic showing how the dive response is induced in the human body.

Methods

Session 1 (All Participants):

- Consent was received.
- Questionnaire was answered.
- Resting vitals (heart rate, oxygen saturation and blood pressure) were measured.
- Video was shown (Figure 12).

Participants were assigned numbers and randomly sorted into two groups; a control group and an experimental group.

Session 2 (Control Group):

- Resting vitals were taken.
- Sign was shown for 20 seconds (Figure 11).
- Dry cloth was placed on their face for 30 seconds.
- Memory was scored.

Session 2 (Experimental Group):

- Resting vitals were taken.
- Sign was shown for 20 seconds (Figure 11).
- Cold, damp cloth was placed on their face for 30 seconds while breath was held.
- Memory was scored.

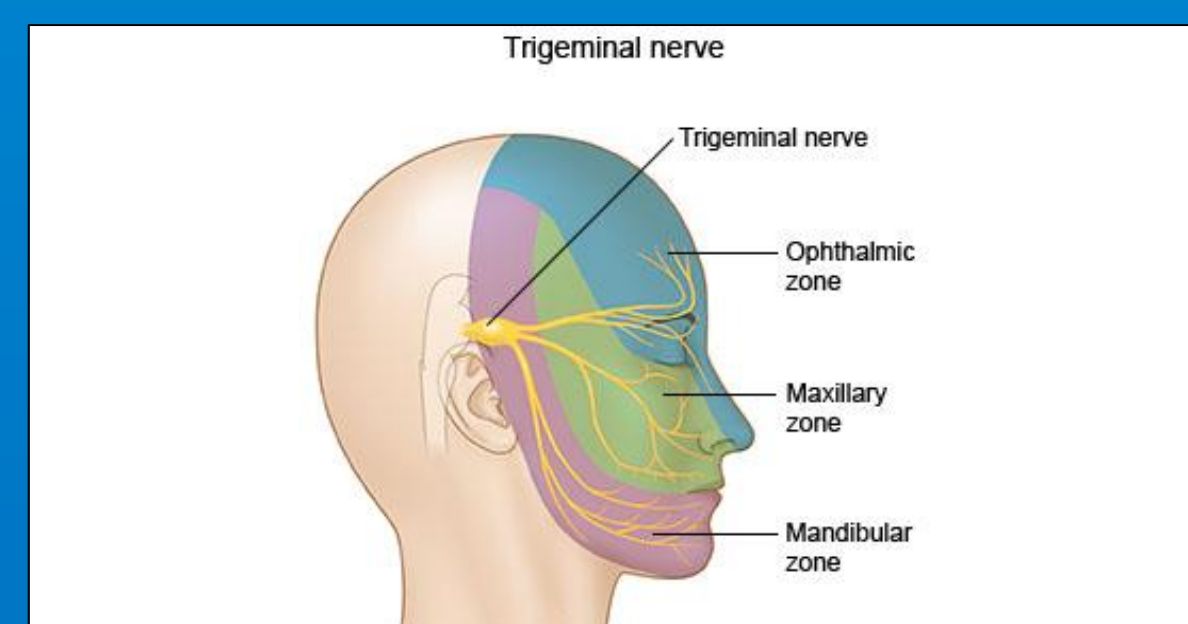


Figure 2: Diagram showing sensory nerves on the face including the trigeminal nerve that is involved in the dive response.



Figure 3: A participant being induced with the dive response.

Results

Heart Rate Change of Control Group (n=15)

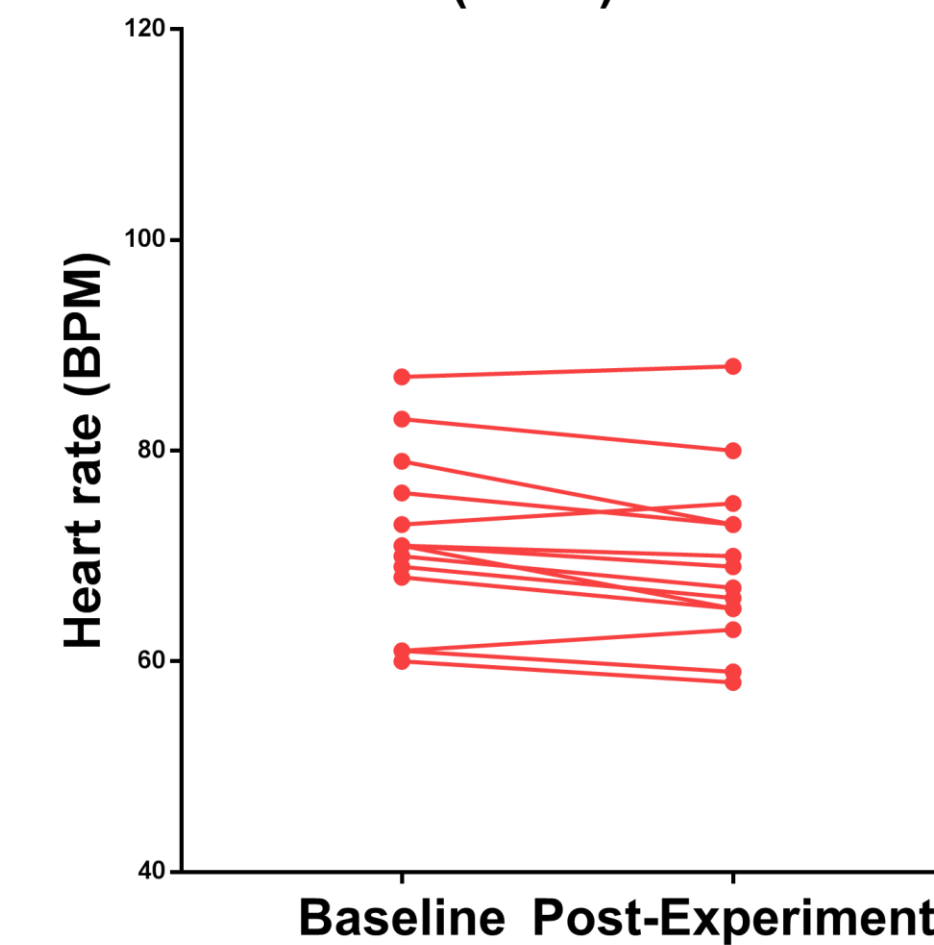


Figure 4: Comparison of baseline and post-experimental heart rate in the Control Group.

Heart Rate Change of Experimental Group (n=13)

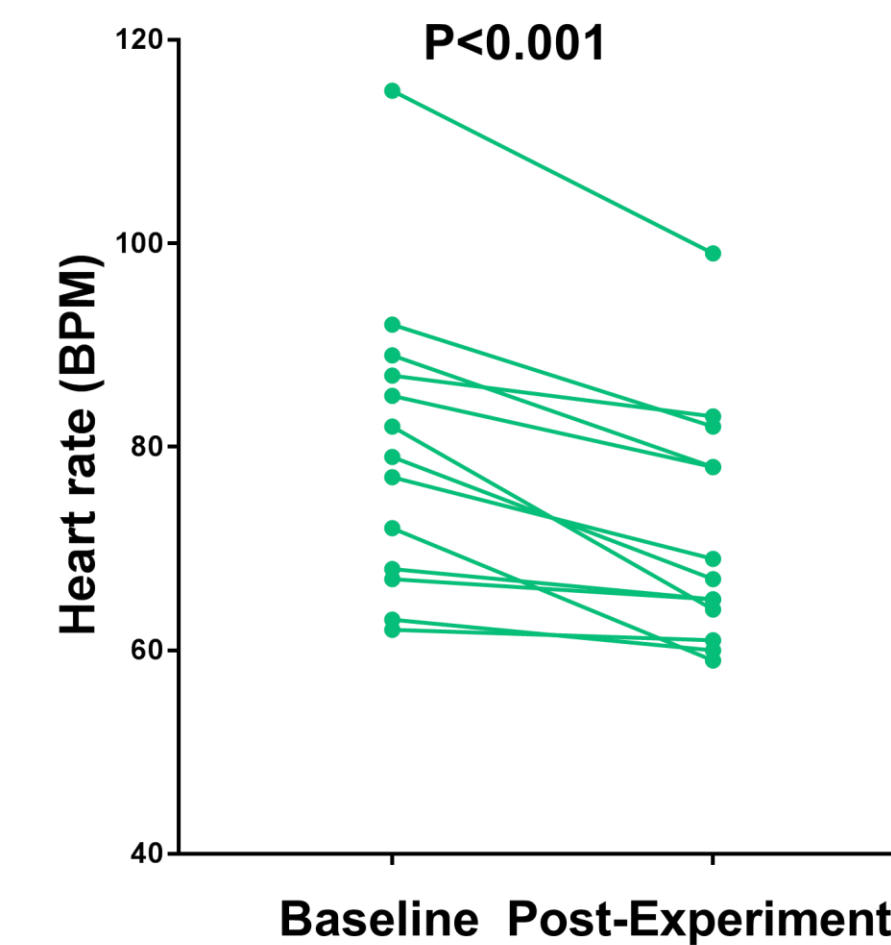


Figure 5: Comparison of heart rate before and after induction of the dive response in the Experimental Group.

Blood Pressure Change in Control Group (n=15)

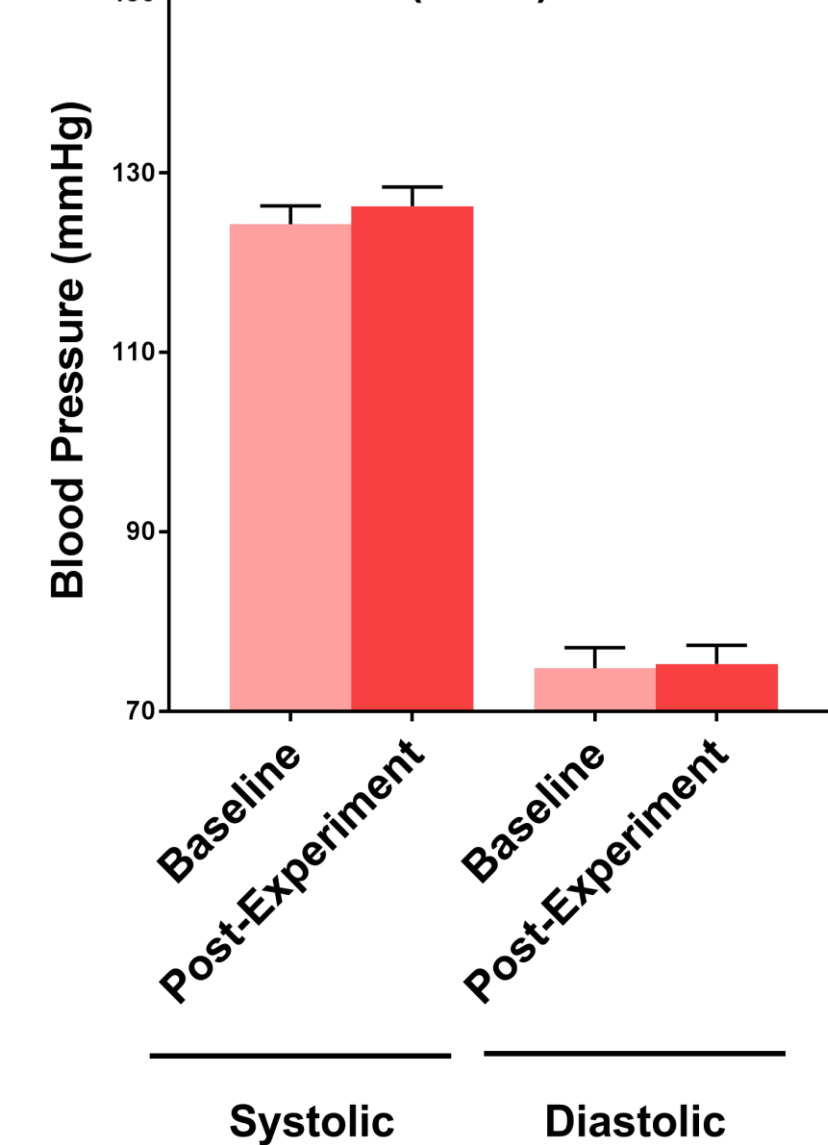


Figure 6: Comparison of baseline and post-experimental blood pressure in the Control Group.

Blood Pressure Change of Experimental Group (n=13)

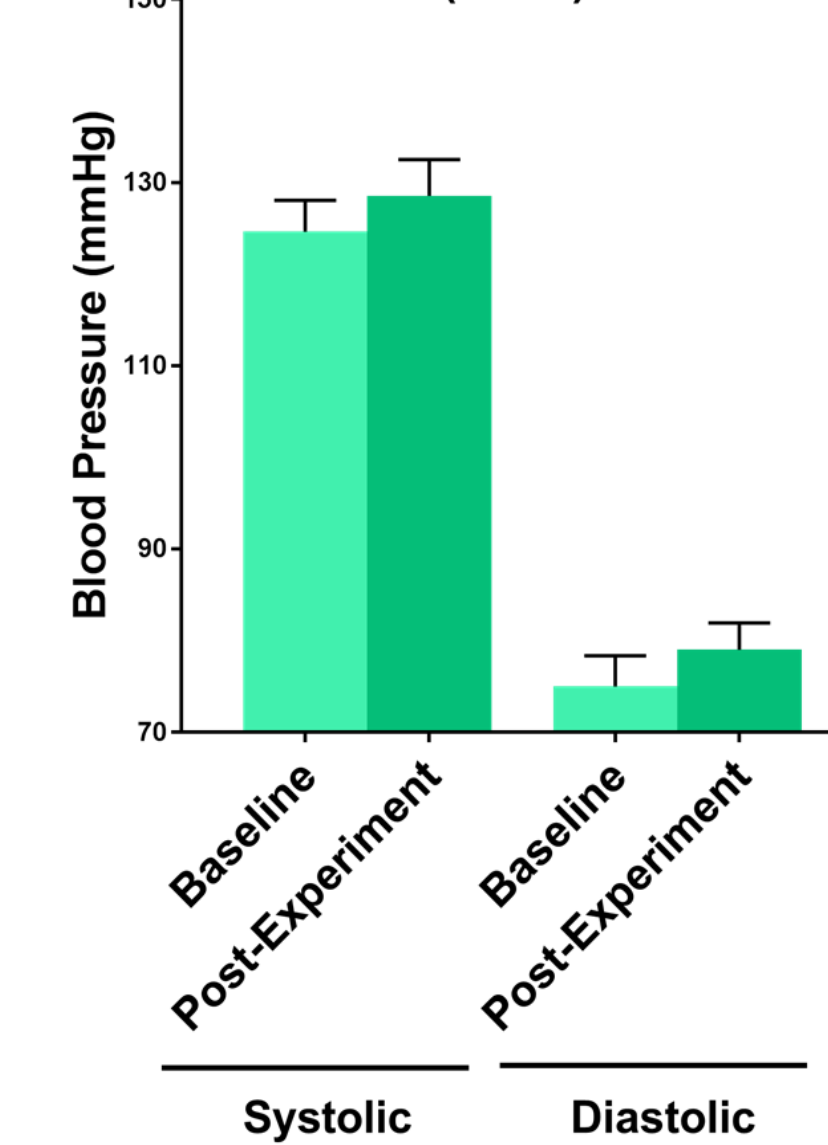


Figure 7: Comparison of blood pressure before and after induction of the dive response in the Experimental Group.

Short-Term Memory (n=28)

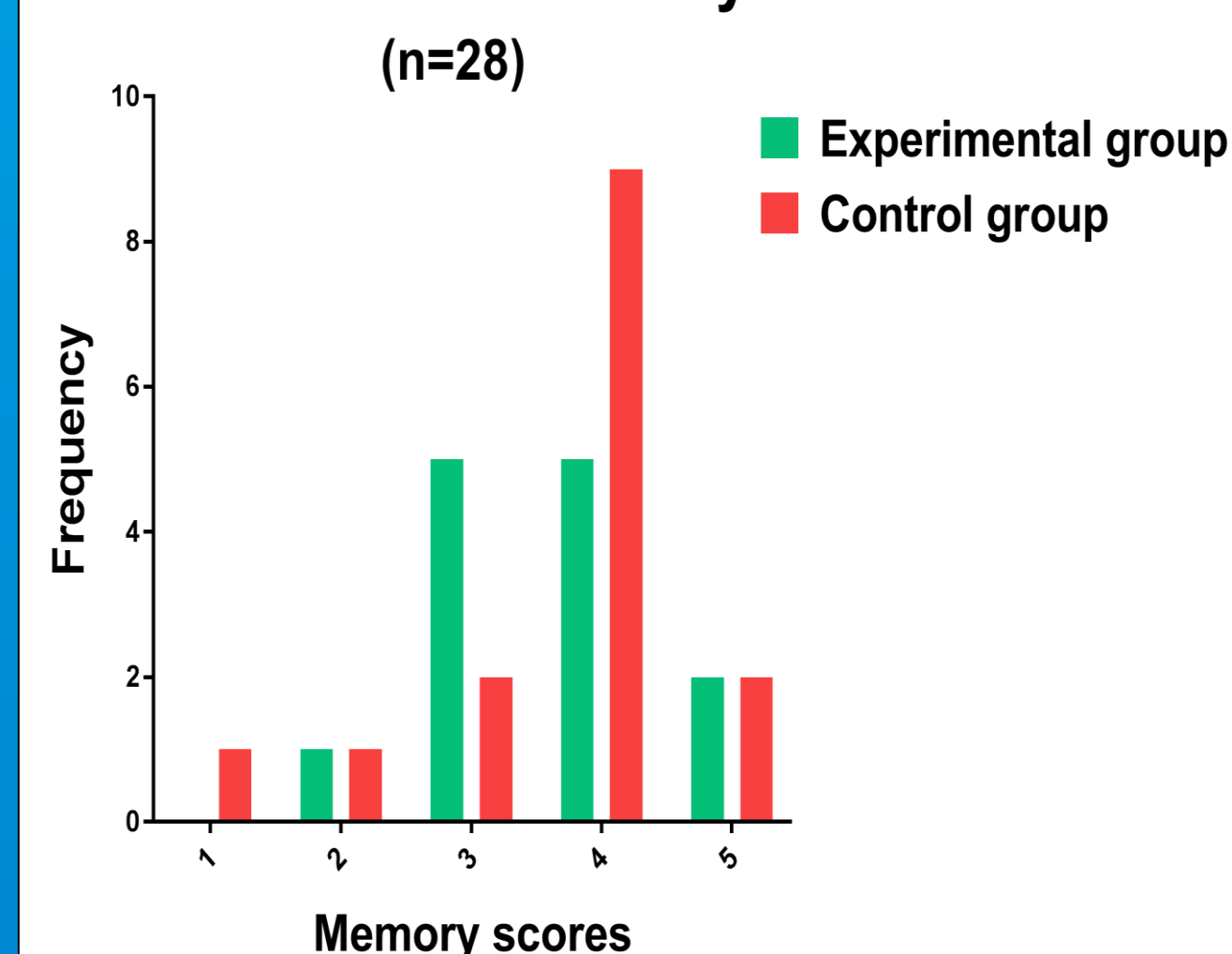


Figure 8: Comparison of short-term memory scores.

Long-Term Memory (n=28)

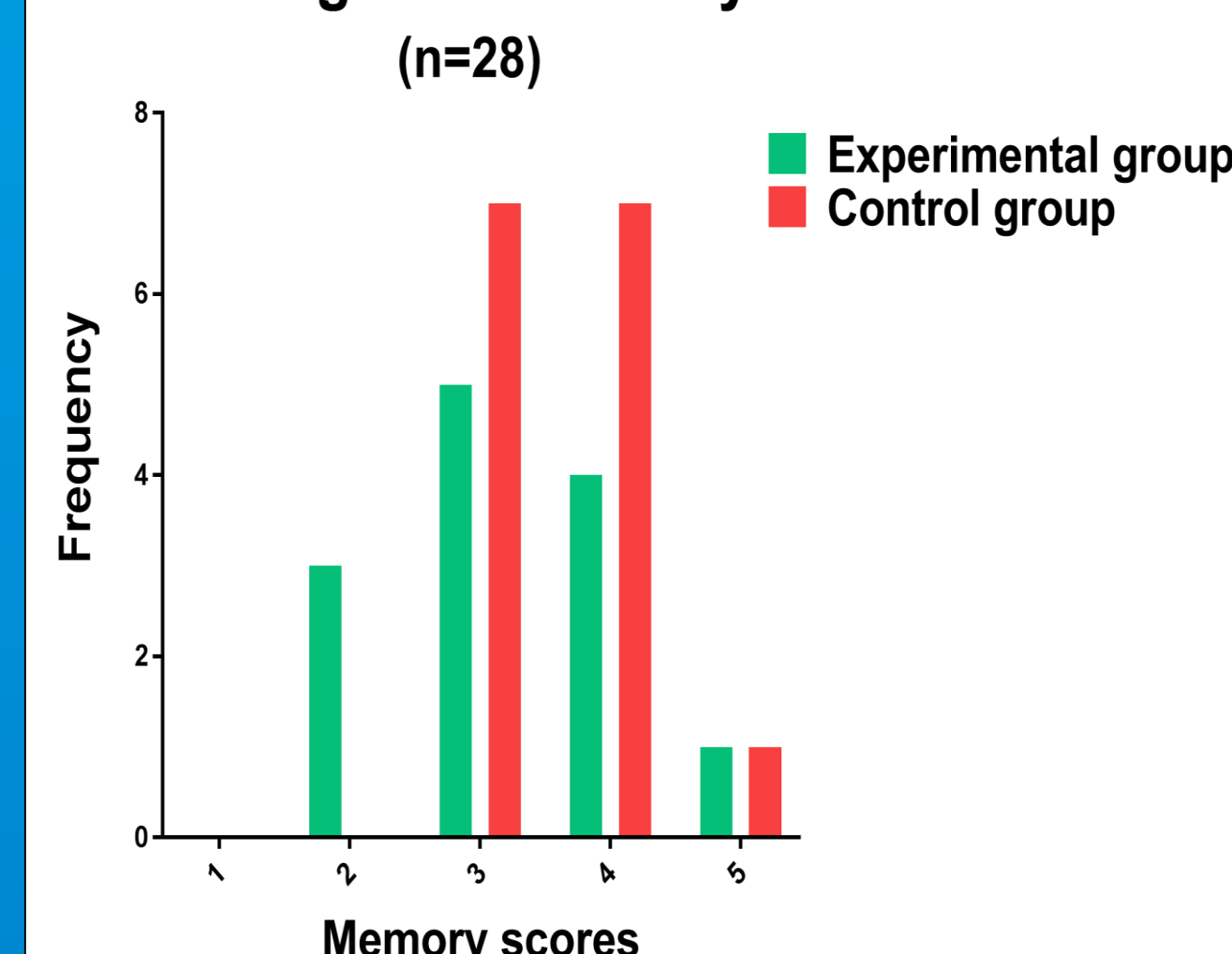


Figure 9: Comparison of long-term memory scores.

Total Participant Self Memory Rating

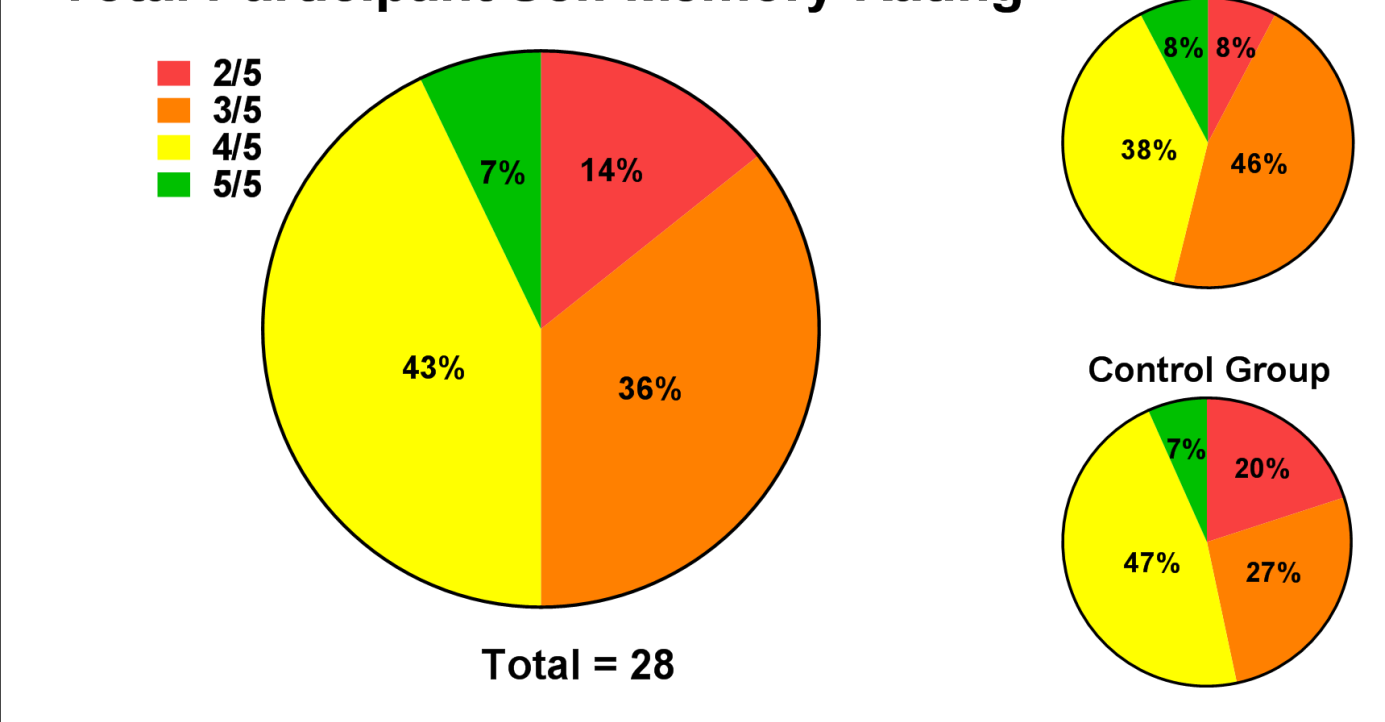


Figure 10: Participants self memory ratings.



Figure 11: The sign used to test short-term memory.



Figure 12: A frame from the RSA cycling advertisement used to test long-term memory.

Discussions

We found that we were able to successfully induce the dive response using facial immersion as the average decrease in heart rate was 10% and increase in blood pressure was 3% (systolic) and 5% (diastolic) for the experimental group (Figures 5 & 7).

According to our study, the dive response has no effect on short-term memory. The average memory score for the control group in the short-term memory assessment was 3.67, and the average memory score for the experimental group was 3.62 (Figure 8). We observed an effect on long-term memory caused by the dive response. In the long-term memory assessment, the average memory score for the control group was 3.6 and 3.23 for the experimental group. (Figure 9)

The experimental and control groups were comparable in age, gender and self-assessed memory recall (Figure 10). Therefore, we can conclude that the dive response may impair one’s long-term memory recall.

Recommendations

Our project concluded that the dive response impairs one’s long term memory. Therefore, we suggest that that the RNLI advertise their ‘Float to Live’ campaign through signs on piers, or near bodies of water in addition to their video advertisement. This will help to communicate their message more effectively and more people may recall the phrase ‘Float to Live’ when they are suddenly and unexpectedly immersed in cold water and the dive response is induced.

It is important that this experiment is carried out on a larger scale using a greater sample size. Including participants of a wider age range would be more representative of the population as people of different ages might have different physiological or psychological reactions to facial immersion.

Future Directions

We would like to see this experiment carried out on a larger scale using a greater sample size. Including participants of a wider age range would be more representative of the population. An equal number of males and females should be included to ensure more reliable and comprehensive results and to improve the statistical power of the study.

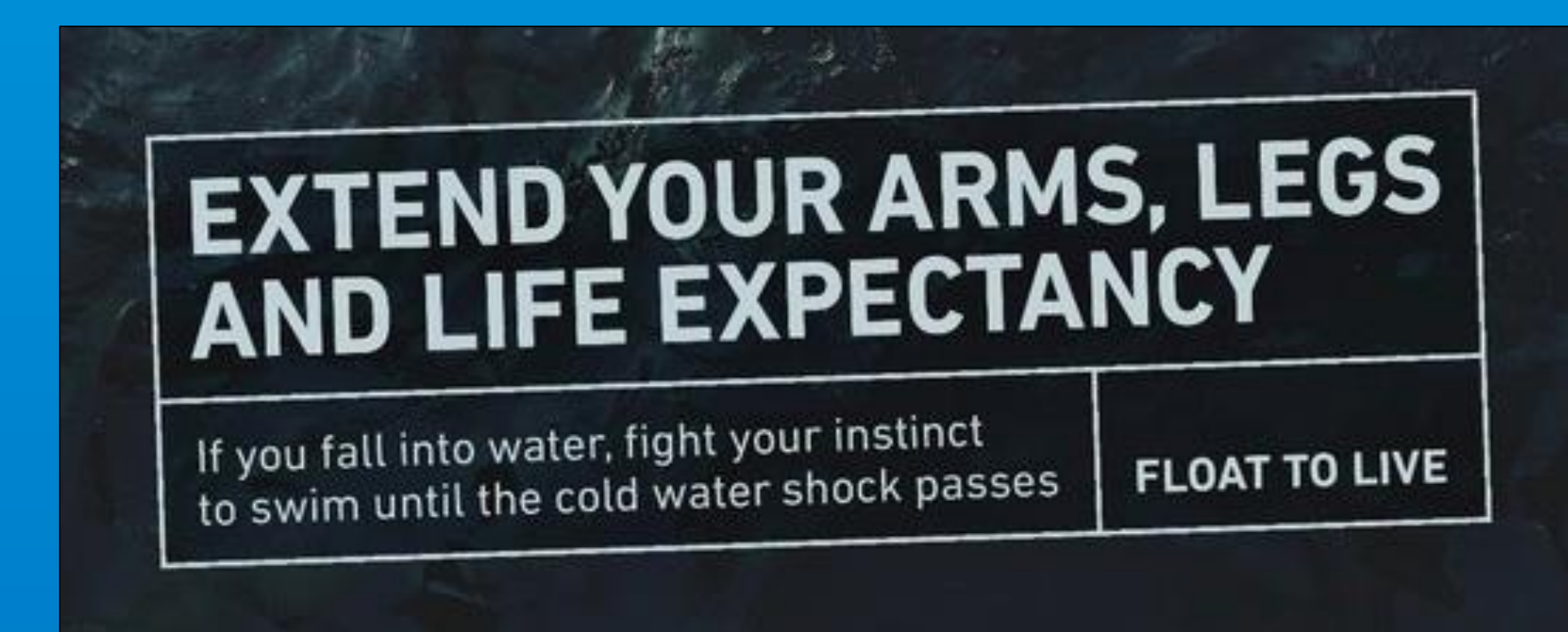


Figure 13: Float to Live advertisement.

Acknowledgements

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