**Experimental Demo report – Simulating heart flow rate using a balloon as a pump**

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1. What is the claim or conclusion in your Experimental Demonstration?

A claim is a statement of a student’s understanding of a phenomenon or the results of an investigation:

- A one-sentence answer to the question you investigated.

- It answers, what can you conclude?

- It should not start with yes or no.

- It should describe the relationship between dependent and independent variables.

Our claim was that obstructing our mock artery straws with blue tack would reduce the measured rate of flow. It would also demonstrate atherosclerosis (the blockage of arteries) (Lusis AJ, 2000) and the effects of blockages on blood flow rate.

We can conclude that the mock artery that was half blocked and fully blocked did indeed have a decreased rate of blood flow compared to the control. The rate of flow was measured by taking the amount of fluid that exited into a container in a 10 second interval. This would give us the rate of blood flow in g/10s which as it is water and not blood, converts 1:1 to mL (mL/10s). Dividing the mL/10s by 10s finds the flow rate in the unit mL/s.

2. What is the evidence in your Experimental Demonstration?

The evidence is the scientific data used to support the claim. Evidence must be:

- Sufficient—Use enough evidence to support the claim.

-  Appropriate—Use data that support your claim. Leave out information that doesn’t support the claim.

- Qualitative, Quantitative, or a combination of both.

When the experiment was conducted, it was performed twice for each treatment and then an average was calculated. An average of 52.5mL (5.25mL/s) of fluid was measured exiting the artery straw of the control (no blockage). With the half blocked and fully blocked artery straw, there was an average amount of 46.5mL (4.65mL/s) and 0.5mL (0.05mL/s) respectively.

3. What is the reasoning for your Experimental Demonstration?

 The reasoning ties together the claim and the evidence:

- Shows how or why the data count as evidence to support the claim.

- Justifies why this evidence is important to this claim.

- Includes one or more scientific principles that are important to the claim and evidence.

The evidence supports our claim. The unblocked control had the highest rate of blood flow. The collected data supports that the rate of blood flow does decrease when there is an obstruction in the blood vessels. The average rate of blood flow changed from 5.25mL/s (control) to 4.6mL/s (half-blocked experimental) and then lastly to 0.05 mL/s (full blocked experimental). This conclusion is supported by Chaundhry R et al. (2022) who found that flow of blood is inversely proportional to the total cross-sectional area of blood vessels. Though these are the results we achieved when averaged out, the individual results of the half-blocked experimental show flow rates equivalent to the control and another drastically less than the control. Ideally, we should have ran at least one more half-blocked experimental to determine which result was more likely to be accurate.

4. List the independent variable(s) in your Experimental Demonstration.

The independent variables were time and the pressure exerted onto the balloon drum

5. List the dependent variable(s) in your Experimental Demonstration. Also briefly explain why these are dependent variable(s).

The dependent variable was the amount of fluid measured after 10 seconds of pumping because it is directly affected by the independent variables where the more time that passes and the more pressure exerted affects the final measured fluid amount.

6. List the controlled variable(s) in your Experimental Demonstration. Also briefly explain why these are controlled variable(s).

The controlled variable was the length of the artery straw in the blood and the vein straw in the air. We kept this length constant and unchanged throughout all the treatments.

The balloon drum was identical throughout each treatment with the aim of eliminating differences in balloon elasticities affecting the results of the experiment. We yield that through extended use as we performed the treatments may have affected the results. Macroscopically, balloons appear to be able to stretch and retain their original shape so extended use of the same balloon affecting the results does not seem credible without further research. Another experiment could be done on determining if there is a non-negligible difference between balloons a given identical batch.

The amount of water should have been better controlled (i.e. refilled after each attempt) to eliminate it from potentially interfering with the pressure needed to force the water out the artery straw. We believe that this may have skewed the results of each treatment’s second attempt to show less flow.

There were attempts to standardise the pressure exerted on the balloon before the experiment but we did not find a solution except for pushing roughly 2cm into the elastic. This can be considered as controlled as careful care was taken to ensure this but human error is inevitable and may have been a factor in the imperfect results recorded. In hindsight, a simple small weight like a dense rock may have sufficed for truly controlled results.

7. List the references (books and journal articles) used in preparing your report.

- The list of references must follow an accepted referencing style (such as the APA style).

-  Lecture notes and websites are not suitable references.

- No textbooks either.

American Heart Association (27 September 2016), ‘How a Healthy Heart Pumps Blood’, American Heart Association, Youtube, accessed 4 May 2024. <https://www.youtube.com/watch?v=zHo-oVOqu1I>

Chaudhry R, Miao JH and Rehman A (2022) *Physiology, Cardiovascular,* StatPearls Treasure Island, Florida

Lusis AJ (2000) *Atherosclerosis*, Nature, 14;407(6801):233-41. doi: 10.1038/35025203.

Science Buddies (19 August 2017) ‘Modeling Blood Flow’, Science Buddies, Youtube, accessed 25 March 2024. https://youtu.be/yYDSqsJqyxE?feature=shared