



**CALIFORNIA STATE SCIENCE FAIR
2004 PROJECT SUMMARY**

Name(s) Katherine Sengoba	Project Number S1010
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Project Title
Effects on Heart Rate and Cardiac Output on Model Heart When Tube Size Altered to Show Atherosclerosis and Valve Disease

Abstract

Objectives/Goals
The purpose of this project is to explore what happens to the heart rate and the cardiac output in hearts that have atherosclerosis in the aorta and valve disease on the mitral valve

Methods/Materials
A model heart was constructed from bottles, tubes, car valves and fountain pumps to carry out this experiment. Holes were drilled into the four bottles and valves with the help of tubing were put into them to represent the different valves of the heart. The bottles were connected to tubing, which was attached to pumps, which represented the heart's pacemaker providing the mechanism to pump the blood through the system.
Three experiments were done. The first experiment was to represent a normal heart. On the second experiment, representing atherosclerosis, a clamp was tightened on the tube that represented the aorta. This represented the plaque buildup in a living heart because the amount of blood flow was restricted. The third experiment represented valve disease and here the clamp was placed on the valve that would represent the mitral valve in real life. Because of the equipment used, the data that was collected was only that of the cardiac output. Therefore, it was realized that only by using the formula for cardiac output, deriving various formulas from it and the stroke volume of a real person under such conditions as those in the experiment, could the heart rates were determined.

Results
Normal Heart: Average Cardiac Output was 855. mL/min; Experimental Heart Rate Avg. was 12.2 beats/min.
Atherosclerosis Heart: Average Cardiac Output was 756 mL/min; Experimental Heart Rate Avg. was 13.8 beats/min.
Valve Diseased Heart: Average Cardiac Output was 751 mL/min; Experimental Heart Rate Avg. was 14.2 beats/min.

Conclusions/Discussion
The results of experiment mostly supported the original hypothesis. It was observed that the cardiac output and the heart rate were inversely proportional. The cardiac output of the heart with atherosclerosis was reduced compared to the normal heart, increasing the heart rate. In the heart with valve disease, the cardiac output was lower than that of the heart with atherosclerosis, which increased the heart rate to be higher than that of both the heart with atherosclerosis and the normal heart. The combination of the experiments showed that when various parts of the heart are manipulated the heart rate and cardiac output

Summary Statement
The project was about discovering how the heart rates and cardiac outputs of hearts with atherosclerosis and valve disease compare to that of a normal heart.

Help Received
My father was my partner in carrying out various parts of the experiment when taking the cardiac outputs.