

Effects of moderate hyperhydration on blood pressure biology essay



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Introduction

The heart is an efficient machine that supplies the body with oxygenated blood and recycles unoxygenated blood (Weedman, 2009). Unoxygenated blood comes into the heart, is pumped to the lungs, oxygenated, and then returned to the heart to be pumped to the rest of the body (Weedman, 2009). Blood pressure (BP) can be found by measuring systolic over diastolic pressure. Systolic pressure is the pressure in the blood vessels while the hearts beats while diastolic pressure is measured by the pressure after the heart beat (Weedman, 2009). Diastolic pressure is also called the “ filling stage” because it occurs when the heart is in a state of relaxation and the semi-lunar valve is closed (Weedman, 2009). In opposition, systolic pressure transpires during contraction where the tricuspid and bicuspid valves are closed (Weedman, 2009).

Heart Rate (HR or also referred to as pulse rate (PR)), read by taking a pulse either on neck, upper arm (most precise measurement) or wrist, uses arterial pressure to calculate the rate that blood is flowing through the arteries (Weedman, 2009). It differs from blood pressure and is the number of times the heart beats in one minute (Weedman, 2009).

Heart rate and blood pressure are great points of interest in the human population because of the importance of the heart in human anatomy. The heart muscle is pertinent to survival and therefore been tested and experimented on habitually. Many tests have been done on the heart by many well established doctors. One of these studies tests the effect of respiratory ailments and stress on heart rate (Weber, 1985). The results

show that heart rate and blood pressure are directly correlated with stress, meaning that when someone is stressed the harder their heart pumps and the more pressure is put on the muscle(Weber, 1985). Nevertheless, there are many other factors that affect heart rate and blood pressure. Most of the factors discussed share a direct correlation with heart rate.

There are also some lifetime diseases that stem from vascular problems that were before thought to have little to no affect (Skoog, 1996). For instance, a study conducted about Dementia revealed that most victims also consistently had high BP. There is more hypothesized evidence that supports this claim, but it has yet to be proven. Despite the ambiguity of the correlation of BP and Dementia, there are many health related concerns that surrounds BP and HR. This is pertinent to the experiment conducted because it questions what health hazards surround dehydration.

As the research of BP and HR becomes more involved, so do the experiments concerning them. In the experiment conducted in LIFE103, a biology class at Colorado State University, 27 subjects tested the affects of hydration on BP and HR/PR. It is hypothesized that there will be a significant change in both BP and HR this is relevant because previous studies showed that a change occurred in similar experiments (Mountain and Edward, 1992). It's predicted that BP and HR will decrease after the addition of water into the body.

Materials and Methods

All variables were kept as similar as the environment would allow and subjects didn't consumer water for two hours before experimentation was started. There was an uneven mixture of male and female and all students

were of different weights, but roughly fell into a broad spectrum of “normal” weight. Three basal readings were taken from the 27 participants. The participants measured themselves using a sphygmomanometer and recorded both heart rate and blood pressure. These were then averaged and if the average was off, additional measurements were taken.

Heart rate and blood pressure served as the independent variables, while the dependent variables were the water and the environmental factors.

After basal measurements were completed students drank 2 cups of water. Water temperatures varied from room temperature to cold and data was separated according to what temperature water subject drank. The subjects were given five minutes to consume the water.

A reading was taken directly after the water was completely consumed. Readings of BP and PR were taken in increments of three minutes since the initial reading until the time struck twelve minutes. There were five total readings. Information from all of the subjects was gathered and charted.

Data was analyzed by comparing data to previous tests, earlier hypothesized values, and T tested. Probabilities were found and then information was compiled into a list of results. Excel was used to assemble the results and create graphs and tables.

Results

The experiment took approximately twelve minutes after water was consumed. The 27 subjects did not drink anything for at least two hours prior, dehydration levels; however were minimal because students were told

to keep at a comfortable hydration level (and two hours isn't sufficient to dehydrate a body completely). Hydration levels after drinking approximately two ounces of water were also minimal because of the small amount drunk. Differences between heart rate and pulse rate are not obvious before and after consumption of water.

The pulse rate (or heart rate) had a more visible change. Comparing averages of final PR (twelve minutes after water was drunk) to the basal reading yielded a change, but it was within a hundredth of a decimal point. The change in blood pressure was also nonexistent. Though, if compared the values of diastolic and systolic pressure change more significantly than the values of the PR.

The data is summarized below in a mixture of charts and written description.

This simply surmises that the average PR basal reading is less than the average post PR at twelve minutes. However, the data is inconsistent because the basal reading is a collection of three different measurements and there could be unknown outliers.

Doing a T test, the information is shown to be probable ($P < .05$), however the more T tests performed comparing the beginning data with the end result (going from left to right on the table), the T tests score above the optimal range. This means that the data cannot be concluded to be within the appropriate range to draw that the data supports the hypothesis (basically we fail to reject the null hypothesis).

PR T Test

PR vs PR

PR1 Basal vs PR 12 min

PR2 Basal vs PR12 min

PR3 Basal vs PR12 min

PR0 min vs PR12 min

PR3 min vs PR12 min

PR6 min vs PR12 min

T Test

. 00028

. 00028

. 00079

. 772211

. 979664

. 413052

T test scores based on excel calculations concerning an experiment performed in class. ($P < .05$) makes the probability of legitimacy high.

Table 1

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The results were inconclusive, the changes were so minimal that (when averaged) the difference between the beginning pulse rate and the final pulse rate were within hundredths of a decimal of each other. Blood pressure had little change. Systolic pressure decreased slightly as did diastolic, but it was too such a degree that the change could be accounted by many variables. Drawing these conclusions, earlier hypothesis and prediction cannot be supported (this conclusion supported by T-test).

The chart below shows the change of pulse rate after the water was consumed. There is no significant change as the time progresses.

Average of PR taken at times 0, 3, 6, 9 and 12 were used compared to the time that the experiment progressed over.

Figure 2

Comparatively, blood pressure had similar results. On a time scale, blood pressure had no distinctive change. Figure 3 is the change in systolic pressure over time while Figure 4 is the change of diastolic pressure over the time stretch that the experiment was done in. It shows that nothing can be conclusively found about either pressure because the unpredictable nature of the line.

Discussion

As earlier hypothesized blood pressure will change and so will heart rate, however they will not be affected heavily because of the small amount of change that is being inflicted upon the subjects. It was predicted that after

an amount of time without drinking any water the subject's heart rate will speed and after water has been added, heart rate will slow down.

Alternatively, the experiment could have been improved with more control. There were many variables that were not accounted for. Water temperature, amount of water drunk, amount of exercise allowed to be exerted by the subjects, sex of subjects, size of subjects and normal heart rate and blood pressure of subjects were not consolidated in the experiment. This could contribute to experimental error, for the hypothesis and predictions are supported according to many experiments done by professional, scientists. These experiments have slightly different variables and test for slightly different results, but their results are conclusive to what should have been found in the experiment conducted in class (this experiment was also performed more professionally with greater differences in the control group and tested group).

In opposition to hydration, dehydration has a lasting effect on heart rate as well (Montain and Edward, 1992). Understanding how dehydration affects heart rate is pertinent to understanding how hydration affects it (Montain and Edward, 1992). Expectations would be that they are complementary of each other and this study titled "Influence of graded dehydration on hyperthermia and cardiovascular drift during excursive" focuses on the dehydration aspect on the body and how the heart rate and blood pressure react (Montain and Edward, 1992). Hyperthermia is another aspect of this experiment, but seeing as it does not pertain to the experiment conducted in class, it will be overlooked (Montain and Edward, 1992).

Directly pulling information from the Montian experiment, there were a certain number of cyclists that took part in the experiment, but they all fell into the same category: capable, normally low heart rate people (1992). Though there was no difference in the amount of sweat that the cyclists produced, there was a significant difference in their heart rates based on what amount of liquid that they consumed (there were four different groups, each assigned to a different amount of water) (Montain and Edward, 1992). The study shows that the level of dehydration directly correlates with HR (Montain and Edward, 1992). The amount of water in the blood indirectly correlates with Heart Rate meaning that the less water there is the harder the heart has to beat in order to get the stagnant blood through the veins and arteries and into the entire body (Montain and Edward, 1992).

The x-axis is time (out of 110), this shows that heart rate. The heart rate increases with the smaller amount of fluid.

An experiment performed by Nadel et al. similarly tests the effects of hyperhydration and hypohydration on the heart rate and the circulatory system, however, the investigation compares and contrasts the two different conditions other than going into depth in one over the other (1980). Maximal arm blood flow was taken for both of the experiments and when in a hypohydration condition, the blood flow was reduced by almost 50% (Nadel et al. 1980). Though there was a difference in the amount of blood when hyperhydration conditions were met (subject drank 2 liters of water), the difference was not significant enough to make a large impact on the subject's heart rate (Nadel et al. 1980). However, when the subject then exercises the heart rate is abnormally slow compared to normal and <https://assignbuster.com/effects-of-moderate-hyperhydration-on-blood-pressure-biology-essay/>

hypohydration conditions (Nadel et al. 1980). A sufficient amount of water also helps maintain a constant internal temperature (Nadel et al. 1980). Temperature is actually a very good way to measure the blood pressure and as seen in the figure 7 blood flow can be measured against temperature to find that the less water a person has, the higher the temperature is (Nadel et al. 1980).

Measures blood flow versus temperature (rectum or esophageal temperature is always used in cases like this).

An earlier experiment performed in the early 1940's noted in "Effect of hydration state on circulatory and thermal regulations" studied the same topic, but in a different manor (Nadel et al. 1980). Their findings were conclusive that even when hypohydration conditions are achieved, when water is given to the subject in large quantities, hyperhydration conditions are easily established and a quick rebound of water replacement in the body takes place (Nadel et al. 1980). In fact, the body reaches a steady condition in much less time than it takes the body to get into a critical condition. This illustrates the fast effects of water retake in the heart rate and body (Nadel et al. 1980).

These detailed experiments are crucial in helping to understand why the classroom experiment had differed results. The study size, though it certainly inflicted the value of the data, was not the problem, but the quality of the subjects. They were all of different athletic potential and did not have similar heart rates or blood pressure rates. The collection procedure itself could also have some error. Subjects measured their own pressures and rates and did

not exactly time it between each three minute intervals. There was also not enough time to collect sufficient data (hours of dedication were needed, not minuet minutes). However, this cannot completely dismiss the experiment, but seeing further evidence from the studies illustrated earlier, it is clear that the classroom results do not correlate with any of this previous research. Even though the experiments were exactly the same, similar results should have been expected because the basic outlines for both of the experiments were the same (Mountain vs. classroom experiment). Therefore, even if both experiments were testing for something different they should have experienced comparable outcomes.

Data and conclusions drawn from this experiment are skewed and cannot accurately portray what happens when a sudden increase in hydration happens in the body. Therefore the null hypothesis has failed to be rejected.

Sources Cited

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