Study of Autoxidation in Hemoglobin in the Presence of Alcohol

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**Background**

In order to learn more about the effects alcohol has on the body, we investigated its effects on the circulatory system. Our bodies’ circulatory systems are the main way that we transport chemicals to where they are needed. One of the major roles of the blood is the role of the red blood cells, which bind to and transport oxygen molecules to our cells where they can be used for cellular respiration. Without the transfer of oxygen, cellular respiration would not be possible, and without cellular respiration, our cells cannot produce adequate amounts of energy.

Hemoglobin proteins in the red blood cells are what make oxygen transfer possible. Hemoglobin is made up of four subunits—two alpha subunits and two beta subunits—and each subunit has a site which can bind to a substrate. In our bodies, that substrate is an oxygen molecule. We call this oxyhemoglobin, and it cannot be used by our bodies. Our goal was to explore how the consumption of alcohol affected this transformation of hemoglobin. We measured the amount of oxyhemoglobin by analyzing the protein absorbance peaks, and we hypothesized that the addition of alcohol would result in a faster accumulation of aquamet hemoglobin.

**Approach**

- We used two cuvettes to mimic the conditions in a red blood cell. One cuvette contained alcohol while the other did not.
- Each cuvette consisted of 120 microliters of 0.176 mM hemoglobin and 100mM HEPES buffer pH7.
- 4 microliters of 100% ethanol was added to 120 microliters of hemoglobin solution to act as the experimental cuvette to achieve a final concentration of 0.553 M.
- The absorbance of each cuvette was measured every 10 minutes for 6 hours and then again at 20 hours.
- The cuvettes were kept at 37°C for the duration of the experiment.

**Results**

After examining the change in absorbance peaks over time, we saw a decrease in the oxyhemoglobin peaks in both the experimental and control cuvettes. This indicates that the amount of oxyhemoglobin gradually decreased. Additionally, we saw an increase in the met specific peak in both cuvettes, which indicates an increase in aquamet hemoglobin.

Next, we looked at the rate at which these changes took place. As shown in Figure 4, the rate of change for both the oxyhemoglobin and the aquamet peaks were the same, regardless of whether or not alcohol had been added to the system. Based on these results, we can conclude that alcohol does not affect hemoglobin function.

It is important to keep in mind that this experiment was performed in vitro. There are many additional processes occurring in our red blood cells simultaneously with this reaction, and different effects may occur under these conditions.

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**References**