

How does caffeine and ethanol affect the heart rate



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At rest a normal adult heart beats around 75 times per minute. During strenuous exercise it may rise to 200 beats per minute. The SAN (sino-atrial node) controls the heart rate. Information is sent via two autonomic nerves that link the SAN with cardiovascular centre in the medulla of the brain, the rate increases or decreases depending on the information received.

Factors, which affect the heart:

- > The secretion of adrenaline. This may be under stress, excitement or other emotions.
- > Movement of the limbs (exercise). Heart rate and breathing rate increase due to oxygen levels falling and levels of carbon dioxide rising.
- > Blood pressure. When blood pressure is too high, a mechanism prevents increase in heart rate.

Adrenaline is a hormone, which is produced by the adrenal gland; it is usually secreted in tiny amounts, when stressed or scared. It raises your heart rate immediately. Adrenaline improves the strength of the contractions of the heart.

Caffeine is a methylxanthine and it blocks adenosine receptors. The chemical formula for caffeine is $C_8H_{10}N_4O_2$.

Medically, caffeine is useful as a cardiac stimulant. Most people associate caffeine to provide a 'boost of energy'. People can become addicted to caffeine; it operates using the same mechanisms that cocaine and heroin

use to stimulate the brain (the affect of caffeine is more mild than that of cocaine or heroin).

Daphnia are common invertebrates, known as water fleas. Their bodies are semi-transparent and the beating of their heart can easily be seen under a microscope.

Hypothesis: I expect the heart rate of the daphnia to increase after being exposed to caffeine. Caffeine is a stimulant; this is why I would make this prediction. I believe that ethanol will slow the heart rate down because it is a depressant.

Materials and methods

In order to carry out this experiment, caffeine and ethanol were used to see if these effect the heart rate using daphnia. Daphnia were placed in a cavity slide, along with some water. Pipettes were used to insert the daphnia into the cavity slide. A cover slip was placed over the cavity slide.

The cavity slide was then placed under the microscope, which was then focused so the daphnia could be observed. The number of beats per minute were recorded by counting the number of beats for 15seconds, then multiplying this number by four. This resulted in the number of beats per minute. Three daphnia were tested, from each one, three recordings were taken.

Cotton wool buds were used to remove the water from the cavity slide.

Daphnia are unable to survive without water, therefore the solution of caffeine/ethanol should replace the water removed as soon as possible. The <https://assignbuster.com/how-does-caffeine-and-ethanol-affect-the-heart-rate/>

caffeine was inserted into the cavity slide along with the daphnia using a pipette. The caffeine needed to be concentrated in order for the daphnia to survive. Again, the slide was placed under the microscope. The same process as before was carried out to record the number of beats per minute.

The concentration of the caffeine used was $1 \times 10^{-5} \% = 0.00001$

The exact same process was used for the ethanol experiment. However, instead of inserting caffeine into the cavity slide, after removing the water, ethanol replaced it. The ethanol also needed to be concentrated and had a concentration of 35%. A concentration of 5% was used, but this proved to be too strong for the daphnia and they died, so 35% seemed to be appropriate.

Lab coats were worn throughout the experiment to ensure no substances were spilt over our clothes. After the experiment, hands were washed so that any possible contact from the water (from the daphnia) was washed.