Hemodynamic Effects of Caffeine

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EMPACTS Project

• The purpose of our project was to gather and analyze data about the effects of caffeine, and its potential long term side effects.
  - To help answer the question: “Can caffeine increase your blood pressure and increase risk of atherosclerotic heart disease?”

• Information was taken from 30 participants who filled out a survey about how caffeine made them feel, and then had their heart rate and blood pressure taken before and after consumption of caffeine.
  This information was assessed and compared to existing studies on caffeine.
About Caffeine

• Caffeine is the most popular drug in the world
  • It is used by as much as 80% of the world’s population (Giardina, 2013)

• It effects the cardiovascular and central nervous systems
• Leads to increased systemic vascular resistance and arterial pressure
Caffeine’s Mechanisms of Action

Caffeine effects the heart in 4 ways

1. Inhibits the phosphodiesterase inhibitor enzymes
2. Binds adenosine receptors
3. Stimulates norepinephrine release – promoting α1 stimulation and vasoconstriction
4. Increases myocardial muscle fiber’s sensitivity to calcium
Caffeine acts like Adenosine

• Caffeine is structurally similar to adenosine, a fast-acting inhibitory chemical in the body. Adenosine binds to A1, A2, and B1 seven-transmembrane-spanning G-protein-coupled receptors.

• These receptors are found in various cell membranes and when bound to adenosine, result in depressed activity

• This depressed activity increases the dopamine and glutamine neurotransmitter activity, which is what causes the feelings of alertness and sometimes euphoria
Caffeine

Adenosine
# Common Sources of Caffeine

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<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Coffee</td>
<td>95-200 mg</td>
</tr>
<tr>
<td>Cola</td>
<td>35-45 mg</td>
</tr>
<tr>
<td>Tea</td>
<td>40-120 mg</td>
</tr>
<tr>
<td>Milk Chocolate</td>
<td>6-9 mg</td>
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</table>
Hypertension

• The leading risk factor in coronary artery disease
  • The leading cause of death in the United States

• Systolic blood pressure (SBP) of 140 or greater

• Diastolic blood pressure (DBP) of 90 or greater
  • normal is 120/80
Project Overview

• A sample of 30 people participated

• Before taking any caffeine, they were given a brief survey to fill out consisting of questions about their current levels of alertness and anxiety, as well as how much caffeine they typically ingest daily.

• Next they had their blood pressure and heart rate taken using a Reli On automated blood pressure cuff to get an initial baseline reading. This information was assessed and compared to existing studies on caffeine.
Safety Concerns

• The school had expressed some safety concerns, as we were administering drugs to people, so an informed consent waiver was prepared.

• This asked people who might have any issues with caffeine to please refrain from taking part in the survey, and informed takers that they were participating at their own risk.

• Also coffee is hot so please don’t burn yourself
The Coffee

• In order to maintain consistency in caffeine doses given to all participants, we selected to use 8 oz Folgers classic roast instant coffee packets.

• These also contain slightly less caffeine, than your average cup of coffee, which was necessary due to safety concerns.

• The coffee was prepared and given to participants, who were to be retested and surveyed in one hour.
  • An hour was chosen because literature review indicated that this is when caffeine has peak bioavailability
Post-Coffee

• After one hour participants were again asked about their levels of anxiety and alertness, and their blood pressure and heart rate were taken again.

• Data was now compiled and plotted, and basic conclusions were drawn.
Sharing with the Community

• A website was made to share our findings with the internet

• It can be found at www.idontknowhatitis.com
A brochure was made to distribute to NWACC students to help the gain a better understanding of caffeine’s effects
Why this is important

• Heart disease is the number one cause of death in North America
• Caffeine is the most popular drug in the world

• Knowing if caffeine is a contributing factor to heart disease is important based on the epidemiology of this disease, and the vast number of people affected by it.
Group Responsibilities

• Kevin Lewis was primarily responsible for background research and for writing the paper
• Kyle Sullivan created a website sharing our findings with the internets
• Ben McGraw was responsible for organizing our information into charts for presentation and for preparing a brochure to distribute to the NWACC community
• Tyler Ramsey made this PowerPoint
• All members helped to accumulate and process data.
Conclusions
About the Participants

- 30 people participated, ranging from 18 - 33 years of age.

- 19 identified themselves as habitual coffee users
  - consuming greater than 2 caffeinated beverages per day on a consistent basis

- 11 identified themselves as non-caffeine users, using it rarely to never
Testing results

• Average MAP ((2DBP)+(SBP)/3) increase among those sampled saw a net increase of 1.87 mmHg

• Habitual users’ average change was -.89 mmHg

• Non-habitual users saw an impressive +6.89 mmHg increase
Chronic Users

• The average Mean Arterial Pressure among chronic caffeine users after consumption was a slight negative, indicating that a tolerance had been acquired.

• This phenomenon was in accordance with current literature’s expected observation of habitual caffeine users

• It is believed that B1, A1 receptor upregulation is mechanism responsible for this response in which the body creates more A1, B1 site receptors as a physiological response to frequent blockage
  • This also accounts for withdrawal symptoms such as headaches and heart palpitations, and similar effects are seen from withdrawal from alcohol and narcotics
Non-Chronic Users

• Observed a rather significant increase in MAP, in line with current literature statistics, of 6.89 mmHg

• This did a good job of illustrating the vascular response to the blockade of adenosine receptors.
Future Development

• To evaluate the significance of caffeine on heart disease, its effects on blood pressure and heart rate would need to be monitored over an extended period of time, possibly years, due to the slow nature of the onset of arteriosclerotic heart disease.

• A broader range of sample diversity including ethnicity and age, as hypertension has a large variance in treatment response based on the factor of race.
References


References Continued


Image References

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