Caffeine Consumption in College Students

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Introduction

Caffeine consumption has greatly increased in the past two decades with college students being a major contributor to the population that regularly consumes caffeine. A study conducted by Diane Mitchell and others used a comprehensive survey to determine the severity of caffeine consumption across the US. The survey of over 37,000 consumers across the US found that 85% of the US population consumes at least one caffeinated beverage per day (Mitchell et al., 2014) while a separate survey found that 92% of college students had consumed caffeine in the past year (Mahoney et al., 2019).

Caffeine can be found in many consumable products, such as coffee, energy drinks, tea, and more. Coffee is the most common form of caffeine consumption in both male and female college students with energy drinks being the second most common (Mahoney et al., 2019). Many college students utilize the consumption of caffeine for specific purposes, such as an increase in energy, social inclusion, or the taste of the caffeinated beverages. It was found that the most reported reason for consuming caffeine in some form was to "feel awake", with 79% of consumers in the survey stating that as a reason for caffeine consumption (Mahoney et al., 2019). Just below that, 68% of students listed enjoying the taste as a reason for caffeine consumption (Mahoney et al., 2019).

Despite the immediate effects of caffeine on an individual, like improved alertness, long term effects tend to be overlooked due to a lack of confirmed correlation with caffeine consumption and adverse health effect. Even with a lack of confirmed correlation, it is known that caffeine stimulates the central nervous systems to provide desired effects, therefore, long term side effects, like increased blood pressure, increase risk on an individual's cardiovascular and hemodynamic health (James et al., 2018). Without confirmed correlation, minimal research has been done to determine mortality and morbidity rates in relation to caffeine consumption. But D\despite a lack of research, caffeine is still considered a drug, where individuals can be addicted and experience caffeine withdrawal as well as overdose due to caffeine consumption. Caffeine toxicity and overdose are rare but are seen more often with energy drink consumption than coffee and tea consumption (Murray & Traylor, 2021).

Because of the adverse effects on cardiovascular health and the toxicity of caffeine, organizations like Healthy People 2030 utilize a 10-year plan to "promote, strengthen, and evaluate the nation's efforts to improve the health and well-being of all people" in relation to various behaviors affecting the health of individuals and populations ("Healthy People 2030 Framework", 2021). With the minimal correlation of caffeine consumption and cardiovascular health, Healthy People's objective to improve the overall cardiovascular health in adults along with the similar objectives related to cardiovascular health all work

to improve the specific behaviors related to cardiovascular health and caffeine consumption ("Heart Disease and Stroke", 2021).

Theory

In the field of Health Behavior and Change it is important to understand the many W's of health including but not limited to the Who, What, and Why through investigation and theory. Through the investigation of specific behaviors, it is easier to apply theory as well as determine intervention strategies. To understand the various elements that effect college students and caffeine consumption, many behavior theories have been used throughout research like the Health Belief Model and the Theory of Planned Behavior. Examining and understanding these theories can provide further knowledge and context to influence and potentially change the behavior of college students.

Health Belief Model

The Health Belief Model (HBM) is a known theoretical model designed to explain and change behavior in specific individuals using several constructs like perceived susceptibility, perceived severity, barriers, cues to action, and self-efficacy through an established understanding that individuals will be more or less likely to enact behavior change based on positive or negative understanding of specific constructs. The HBM proved effective in evaluating caffeine consumption in college students and young adults by understanding the perceptions of youth on caffeine consumption.

A research study on South Korean adolescents utilized the HBM to further understand the pattern of use of caffeinated beverages and the factors associated with the behavior (Ha et al., 2017). The constructs of perceived health threat, likelihood of action, and cues to action were used within the study to condense the various constructs of the HBM (Ha et al., 2017). Perceived health threat includes constructs from HBM like perceived susceptibility and severity, while likelihood of action includes perceived benefits and barriers, and lastly, cues to action included various exposures to the specified population that would encourage change to the behavior (Ha et al., 2017).

Evaluation of perceived susceptibility and severity found that 54.2% of energy drink consumers and 41.4% of general participants believed that the beverages have no threat to them while 27% of participants perceive no threat to their human health (Ha et al., 2017). These finding express that most students do not perceive a greater threat to their human health based on caffeine consumption, despite being caffeine consumers or not. The statistics found support the idea that the benefits of caffeine consumption outweigh the susceptibility and severity associated with the behavior.

When evaluating perceived benefits and barriers, also known as 'likelihood of action' in the research study, the significance of these constructs was found to be much greater than perceived susceptibility and severity. Ha et al. (2017) found that participants were 4.43 more likely to favor perceived benefits over barriers and were actively using energy drinks or other forms of caffeine consumption at the time of the study. These findings express a potential relationship between knowledge and beliefs in accordance with caffeine consumption and the positive effects it can have on an individual. In addition to that, the findings can also demonstrate an insufficient amount of knowledge regarding the negative health effects of caffeine on an individual for those who perceive more benefits than barriers when consuming caffeine (Ha et al., 2017).

With the knowledge and understanding that South Korean adolescents further prioritize perceived benefits over perceived barriers as well as severity and susceptibility, it can be concluded that education emphasizing the negative health barriers and potential threats to an individual's health could be effective in changing the behavior. Because South Korean adolescents and college students in the United States are within a similar age range as well as both experience similar pressures to succeed academically it can be assumed that prevention for the South Korean adolescent population can also be utilized for the college student population in the United States.

Theory of Planned Behavior

The Theory of Planned Behavior was created by adding external factors to the Theory of Reasoned Action. In the Public Health field, the entire Theory is known as the Theory of Reasoned Action and Planned Behavior, but for ease of understanding the theory will be referenced as TPB to encompass the entire theory and its additions. TPB functions under the assumption that an individual will perform an action based on their own attitudes related to the behavior as well as the social norm surrounding the behavior. Studies and research use this theory to understand the linear progression between behavior and social norms and therefore the specific intention an individual has to perform a behavior with an assumption that the stronger the intention to perform the behavior the more likely it is to be performed (Samoggia & Rezzaghi, 2021).

Original constructs of TPB include but are not limited to behavioral beliefs, normative beliefs, and perceived power while Samoggia and Rezzagi use attitude, subjective norms, and perceived behavioral control as their constructs in determining the correlation between caffeine consumption and enhance sports performance (Samoggia & Rezzaghi, 2021). Attitude is defined as the "favorable or unfavorable evaluation or appraisal of the behavior in question", subjective norms are an individual

perceptions and societal pressures connected to the behavior in question, and perceived behavioral control includes an individual's opportunities to enact the behavior in question through specific resources and information given to the individual (Samoggia & Rezzaghi, 2021). Attitude, subjective norms, and perceived behavioral control all correlate to original constructs such as normative beliefs, control beliefs, perceived power, and behavioral beliefs.

With the subjective norm being a determining factor in relation to the intention of consuming caffeine for enhanced sports performance and the research finding that the overall subjective norm was negative toward the behavior it can be assumed that the subjective social norm would further influence individuals away from the behavior (Samoggia & Rezzaghi, 2021). However, many participants reported high positive intention toward the behavior with increased positive knowledge in their self-efficacy in controlling the consumption and after-effects of caffeine consumption.

Furthermore, with these findings it can be concluded that changing the caffeine consumption in college students to enhance academic performance would best be utilized when approaching the subjective social norm related to the behavior and not the intention. If the specific purpose is to be ignored and the data looked at objectively, the key determinant of subjective norm has a stronger perceived power than the intention behind the behavior. Therefore, it would be most beneficial to associate a change to subjective norm toward caffeine consumption in general from a positive to a negative outlook because of further knowledge implemented on the negative effects of caffeine consumption, specifically in college students.

Intrapersonal Factors

Intrapersonal factors include, but are not limited to, an individual's personal knowledge, beliefs, values, and attitudes toward a specific behavior. Intrapersonal factors also include an individual's skillset, demographic, personality, and status. Intrapersonal factors act as the foundation for a person's behaviors. Understanding the intrapersonal factors of college students as a population of interest when it comes to caffeine consumption can aid in the determination of a specific implementation of policy and intervention. In association with caffeine consumption, intrapersonal factors act as a major component of an individual and population's behavior due to confounding variables like societal norms that further influence a person's beliefs, values, and attitudes.

Among college students, taste is the most common reason for caffeine consumption with other reasons varying based on the product consumed (Ágoston et al., 2017). Habit and social motive are also found to be contributing factors to caffeine consumption with coffee and tea showing significant correlation to both habit and social motive (Ágoston et al., 2017). With taste being the common

denominator for lack of a better term, it can be assumed that an individual's attitude toward caffeine consumption is dependent on the taste of the beverage or form of caffeine consumed. If the form of caffeine consumed is perceived to taste good, an individual is more likely to seek out the form of caffeine again as well as influencing an individual's belief toward said form of caffeine to be more positive. After a positive belief is established through a change or enhancement of an individual's attitude, other intrapersonal factors are more easily influenced. With a more positive belief and attitude toward a specific form of caffeine consumption an individual's value toward the form of consumption is further influenced and increased with more positive interactions.

An individual's personal knowledge on the behavior in question is also a major determining factor in understanding caffeine consumption, especially in college students. Within the college student population alertness is a large contributing factor to caffeine consumption for varying reasons. Specific reasons include but are not limited to, ability to stay awake and assistance in waking up regarding various forms of "alertness" understood within the college student population. More than half of participants in Hardy et al's study report increased alertness and focus when consuming energy drinks as their form of caffeine consumption while also finding no correlation between knowledge and energy drink consumption (Hardy et al., 2021). It can be assumed that individual's that consume caffeine on a regular basis are knowledgeable about the effects it can have on the body, both positive and negative, and choose to consume their desired form of caffeine for the desired effects despite the negative effects that are also reported like trouble sleeping and tremors (Hardy et al,. 2021). In addition to Hardy et al's findings a separate study found that symptoms of insomnia are associated with caffeine consumption adding to potential negative effects that are ignored by chronic caffeine consumers (Chaudhary et al., 2016). Furthermore, it can also be assumed that those who chose to not consume caffeine are knowledgeable on the positive and negative effects on the body and therefore choose to avoid consuming caffeine because of the negative effects reported.

In conclusion, intrapersonal factors like attitudes, beliefs, and values have a greater impact on caffeine consumption than knowledge. With societal factors and social norms influencing beliefs and attitudes and each further influencing the other the beliefs and attitudes of an individual are more likely to impact and influence behavior because the perceived benefit of caffeine consumption is greater than the knowledge of negative effect in relation to consumption.

Interpersonal Factors

Interpersonal factors include, but are not limited to, an individual's family and friends, coworkers, and peers. Interpersonal factors consist of the people directly involved with an individual. These specific factors emphasize an individual's place in society and how that influences their behaviors. Societal groups, peers, and other influential people in an individual's life would fall under the umbrella of interpersonal factors. These social relationships can greatly influence the behavior of an individual, albeit negatively or positively. When in relation to caffeine consumption in college students, societal factors play a major role in the population's overall behavior.

It is understood that an individual's family and friends are major contributors to an individual's personality, beliefs, and behaviors due to the proximity of family and friends to the individual as well as the time spent around said family and friends. In a study on perceived self-depression, it was found that many participants related spending time with family and friends and frequency of seeing family and friends as contributing factors to their depressive feelings with less time spent with family and friends resulting in more isolated feelings contributing to their depressive feelings (Badri et al., 2021). This study demonstrates the overall effect family and friends can have on an individual, because if family and friends can affect the feelings of an individual it can be assumed that behaviors are also influenced greatly by family and friends as well.

A study conducted researched adolescents' knowledge and beliefs regarding caffeine consumption through beverages and found that adolescents identified various reasons for caffeine consumption with influences noted greatly to be attributed to parental influence, media and advertising, and social norms (Turton et al., 2016). Influences like media and advertising will be discussed more in the section proceeding this but in relation to parental influence and social norms both are included within interpersonal factors. With adolescents noting the influence parents have on their knowledge and beliefs modeling quickly follows, therefore influencing whether individuals partake in caffeine consumption or not.

Social norms are also noted in Turton's study as factors influencing the knowledge and beliefs of adolescents (Turton et al., 2016). The research noted that choice and consumption of caffeine by the participants were influenced by the frequency and type of consumption by their peers surrounding them as well as how negatively is it perceived if a caffeinated beverage is offered and then turned down (Turton et al., 2016). Turton's study highlights the influence peers can have on an individual's behavior by expressing adolescent's beliefs toward caffeinated beverage consumption being influenced by their environment and the people around them.

It can be further concluded that multiple interpersonal factors influence a person's intrapersonal factors including perceptions, beliefs, values, and the behavior of an individual depending on the importance of specific relationships with the individual. Severity of connection with the people surrounding an individual like family, friends, and peers can further influence the behavior of an individual and further influence the perceived benefit of a behavior.

Organizational, Community, Environment and Policy Factors

Caffeine consumption may primarily be at an individual level, but organizations, community, environment, and public policy all have some effect on the consumption of caffeine in college students. Organizationally, the college or university system has heavily influenced caffeine consumption. As mentioned previously, the most desired effect of caffeine consumption is alertness which is obviously desired by college students for various reasons. A study at the University of New Hampshire found that 65.7% and 68.5% of students consumed caffeine while studying and doing homework and 82.1% of students consumed caffeine to feel more awake (Olsen, 2013). Likely the aid of caffeine is used due to the number of assignments and length of assignments assigned to college students, causing college students to seek aid in completion of the assignments given. There are also high amounts of pressure to succeed associated with completing an undergraduate degree likely causing individuals to require help in completing assignments "sufficiently" in comparison to their individual expectations of themselves. It is also understood that college students feel a sort of belonging in relation to caffeine consumption due to the prevalence of it on college campuses. The community surrounding college students almost encouraging caffeine consumption creates a sense of belonging for many individuals and a desire to fit in as well because of the specific population that consumes caffeine being so prevalent throughout the community on college campuses.

At the environmental level, the access to caffeine in beverages like coffee and energy drinks play an influential role in caffeine consumption. With chains like Starbucks on many college campuses and on campus shops selling energy drinks, access to caffeinated beverages has sufficiently increased while also catering to the need and desires of college students. The same study at the University of New Hampshire found that 80% of students who drink coffee regularly bought their coffee from dining establishments on campus (Olsen, 2013). Within the same study it was stated that convenience and pricing were both contributing factors to them purchasing the coffee from on campus establishments (Olsen, 2013). In relation to energy drinks, the same study found that students were more likely to buy their desired energy drink from cafes or kiosks on campus (Olsen, 2013). The convenient location was found to be a factor as

well as potential promotional endorsements encouraged students to buy from on campus locations because they believed they were getting a "deal" on the beverages (Olsen, 2013).
On campus establishments, like Starbucks on campus, are often used to get coffee as well as study spaces for many students. This also plays into the community factor as well as the environmental level.

Lastly, public health policy also effects caffeine consumption in college students. Caffeine as a food ingredient has been regulated by the FDA since 1958 and continues to be regulated thoroughly (Rosenfeld, 2014). Caffeine regulation may not control how much caffeine is consumed by college students in a day, although there is a recommended amount, it does, however, regulate how much caffeine can be in each caffeinated drink. Technically, the only regulation on caffeine content in beverages as an additive is on cola-beverages to not exceed 200 parts per million of caffeine in a beverage (Rosenfeld, 2014). This is an attempt at regulating the potential health risks that follow excessive caffeine consumption with two reported deaths being attributed to the consumption of pure or highly concentrated caffeine (FDA, 2016). Despite the FDA trying to regulate caffeine content as an additive, there is no official regulation on caffeine in beverages like coffee and energy drinks. Recently, though, industry guidelines recommend labeling of caffeine content in energy drinks as well as an advisory statement for populations at high risk when consuming caffeine (Rosenfeld, 2014).

Suggestions For Intervention

After researching the various influences on caffeine consumption in college students, a multi-factorial approach for intervention is the most likely to provide change to the behavior. When planning intervention, the most common issues encouraging caffeine consumption in college students should be addressed. Issues like increased accessibility, lack of dependable knowledge relating to caffeine content in specific beverages as well as adverse health risks, and lack of safe alternatives to caffeine consumption should all be addressed. Addressing these issues in relation to caffeine consumption in college students is not only important because the variables are major contributors to consumption of caffeinated beverages for college students, but they are also changeable and easily influenced. Some elements are more easily changed than others but ignoring the more difficult changes deter the overall success of the change in behavior.

Accessibility of caffeinated beverages is not only a major contributing factor to caffeine consumption, but it is also much more changeable than other factors. As stated previously, accessibility of caffeine affects multiple aspects influencing an individual including, but not limited to, environmental factors and community factors. Reduction of caffeinated beverages available for purchase throughout

college campuses can potentially lead to a change in caffeine consumption overall decreasing. For example, if colleges were to reduce energy drink supplies throughout on campus locations, it could be observed that less college students will consume energy drinks thus lowering the rate of caffeine consumption in college students. The study by Turton et al. actually found that policies reducing the availability of certain drinks resulted in an overall reduction in intake of the beverages (Turton et al., 2016). This same construct can be applied to beverages like energy drinks to lower intake in caffeine consumption through that beverage.

Accessibility of coffee is still a major contributing factor but holds more difficulty in changing. Naturally, college campuses cannot simply take out all the Starbucks locations throughout their campuses but a reduction in store hours can limit availability of purchase for coffee throughout campuses and therefore potentially decrease caffeine consumption overall. The same construct of limiting availability found in the study about applies to the hope of reducing overall coffee intake as a caffeinated beverage.

Education is also an important factor that needs to be addressed when conducting intervention programs related to caffeine consumption in college students. Lack of restrictions on beverages like coffee and energy drinks as well insufficient education on recommended caffeine consumption for an individual and adverse health effects regarding excessive caffeine consumption all contribute to a major factor to be changed in behavior. The study mentioned above found that many adolescents had no knowledge regarding caffeine contents in certain products as well as a lack of knowledge of suggested amounts of caffeine to consume (Turton et al., 2016). It was found in a research study to understand self-regulating mechanisms for changing caffeine consumption that seeking knowledge and information was a common technique used in trying to change caffeine consumption (Rodda et al., 2020). If reliable information is presented to the population in question, it is safe to assume that individuals seeking a change in behavior are likely to seek out valid information to further influence positive change.

Lastly, an approach to enact change within college students is to shift the population's, fixation on caffeinated beverages to provide positive effects like increased alertness to healthier behaviors that will provide similar, if not better, positive effects on an individual's life. A connection between many studies researching caffeine consumption connect the behavior to desired effects of alertness and feeling more awake, with a specific study stating that 70% of college students attain insufficient sleep on a regular basis (Hershner & Chervin, 2014). If public health were to shift the fixation from immediate effects to long term positive effects behavior change is more likely to occur. For example, if public health were to educate and provide resources for college students to receive the recommended amount of sleep a

reduction in percentage of college students with insufficient sleep could decrease and therefore effect the need for alertness. With a decreased need to be more alert it can be assumed that caffeine consumption is likely to decrease as well overall.

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