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Review Article

The Use of Caffeine Products in Saudi Arabia

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ABSTRACT

The most used psychoactive substance globally is caffeine. Recently, the introduction of numerous products containing caffeine, as well as shifts in the consumption of both natural and artificial sources of caffeine, has received the attention of health experts. However, there is a lack of information on the consumption patterns of coffee and caffeinated products in different regions of the Saudi population. Therefore, this review aims to identify gender differences, pharmacological effects and risk of toxicity among caffeine product users in Saudi Arabia. Although there are regulations from the Saudi Food and Drug Authority (SFDA), there have been concerns about excessive caffeine consumption among the youth population. According to the available studies, the prevalence of coffee consumption is high among Saudi females. The extent of caffeine toxicity in Saudi Arabia is not well documented; however, given the widespread use of caffeine in the country, it is possible that instances of caffeine toxicity may arise. It should be emphasized that caffeine toxicity is not common and usually occurs only with extremely high levels of caffeine consumption. This review offers valuable insights into caffeine consumption patterns in Saudi Arabia, which can benefit a range of stakeholders, including scientists, healthcare providers and consumers. To ensure safe caffeine consumption and minimise the risk of negative outcomes arising from insufficient knowledge about its use, there is a need to educate individuals and raise public awareness about caffeine intake.

Keywords: Caffeine Products, Saudi Arabia, Caffeine Safety.

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INTRODUCTION

Coffee is the primary source of caffeine consumption in Saudi Arabia, and it is an important part of the country's culture. According to studies, Saudi Arabians consume an estimated 1.2 kg of coffee per capita annually, which is higher than the global average of 0.7 kg per capita per year.[1] In addition to coffee, Saudi Arabians consume other caffeinated beverages, such as tea and energy drinks. Energy drinks are becoming increasingly popular in the country, with brands like Red Bull and Monster Energy having a solid presence in the Saudi Arabian market.[2,3] Caffeine is included in many over-the-counter pain medications, such as Panadol Extra and Fevadol Extra, since it acts as an aid, in some cases increasing the effect of pain relievers by 40%. It also works as a vasoconstricting and anti-inflammatory agent.[4]

A clinical study in Riyadh found that 87.2% of respondents consumed caffeine on a regular basis. The most common source of caffeine was coffee, followed by tea and energy drinks.[5] Another study found that 30% of adolescents reported consuming energy drinks at least once a week. The study also found that energy drink consumption was associated with poor sleep quality and a higher risk of health problems, such as obesity and dental decay.[6] Caffeine is generally considered safe for healthy adults, but it can have both positive and negative effects.

On the positive side, caffeine can enhance mood, cognitive ability, exercise performance and metabolism.[4] However, negative effects can occur when caffeine intake exceeds 400 mg, which is roughly equivalent to three to four cups of brewed coffee. This can lead to a condition known as caffeine intoxication, which is characterized by symptoms such as sleep disturbance, increased urination, gastric irritation, headache, irregular or rapid heartbeat and psychomotor agitation. These symptoms are defined by the Diagnostic and Statistical Manual of Mental Disorders, fifth edition (DSM-5).[7]

Saudi Arabia is an Islamic country, and according to Islamic law, consuming alcohol and other intoxicants is strictly prohibited.

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Coffee, however, is considered halal or permissible, and it has been a traditional part of Saudi Arabian culture for centuries. As a result, coffee consumption is widely accepted and shared in the country, regardless of gender.[8] This review aims to identify the gender differences, pharmacological effects and risk of toxicity among caffeine product users in Saudi Arabia.

Gender differences

There is limited research on gender differences in caffeine consumption in Saudi Arabia. For instance, a clinical study aimed to investigate predictors of coffee consumption found that the prevalence of coffee consumption was high among Saudi females and that the frequency of coffee consumption was significantly higher ([87%], $p = 0.018$) in single participants than in married participants.[4] Another study in the Western Province of Saudi Arabia showed that females represented 80% of caffeine consumers.[3] Studies have shown that caffeine's effects on men and women may differ. Caffeine may have a greater impact on women's blood pressure and heart rates than on men. Additionally, some research has revealed that caffeine consumption may impact women's oestrogen levels and raise their risk of developing certain illnesses, such as osteoporosis and breast cancer. To fully grasp the effects of caffeine on different genders, more research is required.[9,10]

Consumption of caffeine varies between genders, with females tending to consume and prefer coffee and tea, while males prefer caffeinated energy drinks and carbonated soft drinks. However, the reasons for this gender difference in caffeine intake are uncertain.[10] On the other hand, one study showed that among diabetic patients, males had a significantly higher consumption of caffeine compared to females ($p = 0.021$).[9] There may be some cultural factors that influence caffeine consumption patterns among men and women in Saudi Arabia. For example, there are gender-segregated spaces in many public areas, including cafes and restaurants. Women may be more likely to consume caffeine in private settings, such as at home or in women-only spaces, whereas men may be more likely to consume caffeine in public spaces. Overall, while some cultural and gender-based factors may influence caffeine consumption patterns in Saudi Arabia, coffee is widely consumed and accepted in the country regardless of gender.

Pharmacological effects

It is important to note that the pharmacological effects of caffeine can vary depending on factors such as the individual's tolerance level, the amount and timing of caffeine consumption, and the presence of underlying health conditions. Excessive caffeine consumption can have adverse health effects, including increased anxiety, insomnia and heart palpitations.[11] However, moderate caffeine consumption is generally considered safe for most people. To promote public health, the Saudi Arabian government has implemented regulations limiting the amount of caffeine allowed in energy drinks and other beverages.[12]

The Saudi Food and Drug Authority (SFDA) regulates the production, sale and consumption of food and beverages, including caffeinated products. The SFDA has set maximum limits on the amount of caffeine allowed in energy drinks, which is 80 mg per 100 mL. Furthermore, the SFDA requires energy drink manufacturers to include warning labels on their products, cautioning consumers against excessive consumption.[13,14] The SFDA has established regulations for coffee shops and similar establishments that offer beverages with caffeine, which include directives for maintaining adequate hygiene and food safety measures.[15] The SFDA has also initiated various awareness campaigns to educate the public about the potential health hazards of consuming excessive amounts of caffeine, especially through energy drinks. However, there are still concerns about the elevated levels of caffeine consumption among the youth in Saudi Arabia, despite these measures.[16]

Central nervous system

Caffeine acts as a stimulant in the Central Nervous System (CNS). Caffeine has three distinct CNS modes of action that create a psychostimulant effect. These effects are responsible for caffeine's effect on cognitive performance. Caffeine causes relative brain hypoperfusion by increasing energy consumption throughout the brain, while simultaneously decreasing cerebral blood flow.[17] Caffeine appears to impact the local release of dopamine by activating noradrenaline neurons. Many of caffeine's energising effects could be attributed to methylxanthine's effects on serotonin neurons. The most pronounced impact is alertness. The effects of methylxanthine on arousal, alertness and exhaustion are more closely connected to the effects of caffeine on learning, memory, performance and coordination.[18]

Caffeine is a popular natural stimulant because of its capacity to raise mood, increase alertness and improve cognitive performance. While caffeine has many advantages, some people may experience side effects, such as insomnia, anxiety and high blood pressure. Caffeine should be consumed in moderation and the potential hazards should be understood.[19] Depending on each person's methylxanthine sensitivity, caffeine has varying impacts on anxiety and sleep. For instance, a study in the south of Saudi Arabia found that about 20% of students consumed more caffeine than the recommended daily limit of 400 mg/day. The data also revealed that the year of study was the only demographic variable that had a statistically significant association with caffeine consumption (p value of 0.003).[16] This implies that students who are in their first few years of college or university are more likely to consume more caffeine than the recommended daily limit, as they face the stress of adjusting to a new environment and learning style. In contrast, students in their later years of study

may be more accustomed to the academic demands and less likely to exceed the recommended caffeine intake.

Cardiovascular system

Some studies have suggested that moderate caffeine intake may improve endothelial function, which is the ability of blood vessels to relax and dilate properly, leading to better blood flow and a lower risk of heart disease.[19] Other studies have found that moderate caffeine consumption may reduce the risk of developing heart disease, stroke and diabetes.[20] However, it is important to note that the beneficial effects of caffeine on cardiovascular health may vary depending on individual factors, such as age, sex, genetics and underlying health conditions. Additionally, excessive caffeine consumption can have negative effects on cardiovascular health, and consulting with a healthcare professional is recommended for personalized advice on caffeine consumption and cardiovascular health.[21]

Caffeine has many effects on the cardiovascular system. Adenosine acts on specific receptors in the heart and is a negative inotropic and chronotropic drug. Through high 1β-receptor activity, blocking cardiac adenosine receptors reduces adenosine's actions and may lead to tachycardia and arrhythmias.[20] High levels of caffeine consumption cause adenosine antagonism and phosphodiesterase inhibition, interacting with the sympathetic nervous system and activating A1-receptors.[19] This results in positive inotropic and chronotropic effects, accounting for increased heart rate and conductivity, which increases the chance of ventricular arrhythmias. Caffeine also has a variety of heart-related effects.[22] To begin with, it increases noradrenaline and norepinephrine secretion. These hormones, among other things, increase blood pressure and heart rate.[23] Caffeine may also influence enzymes that stimulate cardiac contractions, causing the heart to contract more forcefully. According to many studies, males had higher decreases in heart rate in response to caffeine than females. An explanation for these effects is that males have a more sensitive baroreflex than females, as stated by several studies.[24]

Gastrointestinal system

After consumption, caffeine is quickly absorbed in the body and reaches its highest concentration in the blood between 15 min to 2 hr. Common sources of caffeine include coffee, tea, and soda, which are easily absorbed in the gut and can dissolve in both water and fat molecules in the body.[25] Caffeine is a stimulant that has various effects on the gastrointestinal system. These effects include an increase in gastric acid secretion, which can cause digestive discomforts such as heartburn and indigestion, and an increase in motility, which can lead to diarrhea or loose stools for some individuals who are sensitive to caffeine.[26]

Caffeine can also interfere with the absorption of certain nutrients, such as calcium, iron, and magnesium, by binding to them and inhibiting their absorption in the gut.[27] Additionally, caffeine can irritate the lining of the gut, causing abdominal pain, cramping, and bloating in some individuals.

After drinking coffee, heartburn is the most frequently reported symptom. Coffee has been shown to increase gastro-oesophageal reflux. Gastrin release and stomach acid output are stimulated by coffee. Additionally, coffee delays the proximal stomach's adaptive relaxation, which raises the possibility that it might delay gastric emptying.[28]

It's important to note that the effects of caffeine on the gastrointestinal system can vary significantly depending on various factors. Genetic differences can affect how quickly an individual metabolizes caffeine, which can make some people more sensitive to caffeine than others.[29] Age can also play a role, as younger individuals may have a lower tolerance to caffeine than older individuals. Body weight can also impact how an individual responds to caffeine, with those with a lower body weight experiencing stronger effects from the same amount of caffeine than those with a higher body weight.[30,31] An individual's overall health can also be a factor, as those with certain health conditions may be more sensitive to the effects of caffeine. Tolerance to caffeine can also develop over time with regular consumption, resulting in some individuals requiring higher doses to achieve the same effects as those who do not consume caffeine regularly.[32] Additionally, the method of caffeine consumption can also affect its effects on the body, with caffeine consumed in different forms having varying effects.

Risk of toxicity

Caffeine toxicity occurs when an individual consumes a high amount of caffeine, typically in excess of 400 mg per day (the recommended maximum daily intake for adults), and experiences adverse effects as a result.[33] The symptoms of caffeine toxicity and their severity can vary depending on the individual's tolerance level and the amount of caffeine consumed, but may include anxiety or panic attacks, insomnia or sleep disturbances, or increased urination.

It is important to note that caffeine toxicity is relatively rare and typically occurs only with very high levels of caffeine consumption.[34] However, individuals who are particularly sensitive to caffeine or who have underlying health conditions may be more susceptible to caffeine toxicity, even at lower levels of consumption.[35] In most cases, the symptoms of caffeine toxicity are relatively mild and include jitters, nervousness and increased heart rate. However, in more severe cases, caffeine toxicity can lead to more serious symptoms, such as seizures, cardiac arrhythmias and even death.[36]

The treatment for caffeine toxicity typically involves supportive care and the management of symptoms to support the body's natural detoxification processes.[37] In mild cases, this may involve

monitoring the individual's vital signs and providing fluids to help prevent dehydration. In more severe cases, hospitalization may be necessary, and medications such as benzodiazepines may be used to manage seizures and other symptoms.[38]

As a rule, it is recommended that adults consume no more than 400 mg of caffeine per day, which is roughly equivalent to four cups of coffee. It is also important to be mindful of the caffeine content of energy drinks and other caffeinated products, which can contain very high levels of caffeine.[39] Individuals who are particularly sensitive to caffeine or who have underlying health conditions should consult with a healthcare professional before consuming caffeine. Pregnant women are also advised to limit their caffeine intake to 200 mg per day to reduce the risk of adverse effects on the developing foetus. There is limited data on the prevalence of caffeine toxicity, specifically in Saudi Arabia. However, as caffeine is a widely consumed substance in the country, it is possible that cases of caffeine toxicity may occur.[40] To prevent caffeine toxicity, it is important to monitor caffeine intake and to be aware of the caffeine content of foods and beverages.[41] Additionally, individuals who are particularly sensitive to caffeine or who have underlying health conditions should consult with a healthcare professional before consuming caffeine.

CONCLUSION

It is currently unclear which types of caffeinated products are most consumed by the Saudi population. Natural sources of caffeine include coffee, tea and chocolate, while synthetic sources include energy drinks, soda and certain medications. This review provides important information about caffeine consumption in Saudi Arabia, which can be useful for a variety of stakeholders, including the scientific community, healthcare professionals and consumers. To promote safe caffeine consumption and prevent negative outcomes due to a lack of knowledge about its use, efforts should be made to educate individuals and increase public awareness about caffeine intake.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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