Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublisher.com/sjams/

OPEN ACCESS

Physiology

Effect of Caffeine on Auditory Reaction Time in Young Healthy Individuals

Sheela Bargal[1], Sarita Mane[2], Priyanka Mirdha[3*]

[1]Assistant Lecturer, Dept. of Physiology, Dr. D.Y. Patil Medical College, Nerul, Navi Mumbai, India
[2]Lecturers, Dept. of Physiology, Bharti Vidyapeeth, CBD Belapur, Navi Mumbai, India
[3]Assistant Lecturer, Dept. of Physiology, Dr. D.Y. Patil Medical College, Nerul, Navi Mumbai, India

***Corresponding author:** Priyanka Mirdha
| **Received:** 22.04.2019 | **Accepted:** 26.04.2019 | **Published:** 30.04.2019
DOI: 10.21276/sjams.2019.7.4.53

Abstract **Original Research Article**

Caffeine is CNS stimulant of methylxanthine class. It is the world's most widely consumed psychoactive drug. The present study was conducted to evaluate relationship between caffeine and auditory reaction time among UG students. The study revealed that there is significant decrease in Auditory RT after caffeine consumption.
Keywords: Caffeine, Auditory Reaction Time.

INTRODUCTION

Coffee was first used as food and later as a hot beverage. Caffeine has been used by humans as a psychoactive stimulant for thousands of years. The predominant source of caffeine in the human diet is coffee. Caffeine is known to stimulate the neurological system and elicit improvement in cognitive function [1]. It brings about a feeling of well-being, relaxation, increased alertness and concentration [2]. Caffeine is a lipid soluble substance classified as purine and can also be referred to as guaranine, mateine or thesis depending on its source. Caffeine is generally found in high concentration in coffee beans, tea leaves, cocoa beans and guarana seeds [3]. The average consumption of caffeine in India is 27mg/person /day. The amount of caffeine in food items ranges from 48-180mg/150ml of coffee, to 24-40mg /150ml of tea and 15-29mg/180ml for colas.

Caffeine in the blood passes freely and quickly through the blood brain barrier due to its hydrophobic characteristics. The easy Passage between the blood stream and the brain allow caffeine to quickly stimulate central nervous system function and improve cognition. [4] Caffeine increase cognitive measures and decrease reaction time. A decrease in RT indicates an improved sensory motor performance and enhanced processing ability of central nervous system [5-7].

Caffeine is a methyl xanthine (1, 3, 7-trimethylxanthine). The effect of this group of chemicals include stimulation of the Central Nervous System (CNS), diuresis, stimulation of cardiac muscle and relaxation of smooth muscle. Caffeine initially stimulates the CNS at the level of the cerebral cortex and medulla and only later stimulates the spinal cord (at higher dose) [8]. Caffeine is rapidly absorbed from the gastrointestinal tract and then metabolized by demethylation and oxidation in the liver [9].

Reaction time (RT) is an indirect index of the processing ability of central nervous system [10]. Reaction time (RT) is the elapsed time between the presentation of a sensory stimulus and the subsequent behavioral response. RT is often used in experimental psychology to measure the duration of mental operations, an area of research known as mental chronometry. In psychometric psychology it is considered to be an index of speed of processing [11]. Reaction time is quickest for young adults and gradually slows down with age. It can be improved with practice up to a point, and it declines under conditions of fatigue and distractions [12]. As the reaction time is influenced by different factors, the impact of psychological stress, gender effect and color of objects. The longer reaction time in females could be due to the effect of female sex hormone, which reduced the velocity of nerve impulse and increased the synaptic delay [13]. The reaction time to sound stimulus is shorter than reaction time to light stimulus [14].The moderate doses of caffeine decreased the time it took subjects to find a target stimulus and to prepare a response for a complex reaction time task [15].

Therefore, the purpose of this study is to see the effect of caffeine on audio reaction time in healthy young individuals.

MATERIALS AND METHODS

The present study was conducted at MGM Medical College and Hospital, Kamothe, Navi Mumbai. In this study 50 healthy undergraduate students, aged17 to 27 (Male-25, Female-25) were taken. The participants should be without any pre morbidities and should not on any medication. Institutional Ethical Committee permission also taken before the study.

The subjects were told to come to the department of physiology in fasting state for this study. The reaction time was studied between 9:00 am to 11:30 am in the morning. Each individual has been explained about the test and sufficient trials have been given for proper understanding. All the subjects had been subjected to the tests in the secluded/quiet room. Before measuring the auditory human reaction time, each has been asked to identify the stimulus (auditory stimulus:SB1, SB2, SB3, SB4) and instructed to press the corresponding response button by the right index finger, as soon as the individual sees the hears the auditory stimulus from the digital display the reaction time was recorded. Three readings for each stimulus were taken and their average was calculated.

Recording of audio reaction time was done with the "techno digital display multiple choice apparatus" Model No-MCR-444 manufactured by Techno Electronics (forsyth Road, Lalbagh, Lucknow-UP-India).

After noting the basal fasting reaction time for auditory stimuli, Nescafe classic instant coffee (100%) natural coffee sachet 0.8 grams dissolved in plain hot water to make 150 ml of coffee with no sugar and milk) was given to each student. One cup of Nescafe coffee contains (150 ml) 75 mg of caffeine. After 15 minutes of coffee intake reaction time was again recorded for each auditory stimulus. Three readings were taken and their average was calculated.

OBSERVATIONS AND RESULTS

Table-1: Reaction time with sound stimulation (Mean ± SD) in males

Sound Stimulus	Before (Mean ± SD)	After (Mean ± SD)	"t" Value	"P" Value
SB1	95.96 ± 18.97	77.40 ± 14.12	9.299	.000
SB2	99.32 ± 16.19	76.40 ± 13.36	8.051	.000
SB3	94.32 ± 17.61	78.96 ± 17.11	9.735	.000
SB4	95.28 ± 17.64	75.60 ± 14.50	8.952	.000

Table-2: Reaction time with sound stimulation (Mean ± SD) in females

Sound Stimulus	Before (Mean ± SD)	After (Mean ± SD)	"t" Value	"P" Value
SB1	103.24 ± 20.28	84.64 ± 15.00	6.999	.000
SB2	101.00 ± 16.81	85.12 ± 15.94	9.416	.000
SB3	104.32 ± 20.51	85.44 ± 14.30	7.574	.000
SB4	99.48 ± 19.07	83.24 ± 16.39	6.956	.000

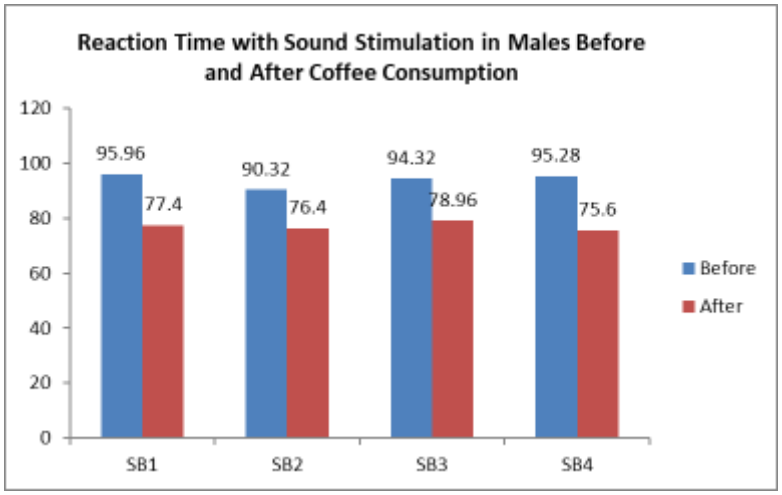
SB1 – Mid Frequency and Low Pitch, SB2 – Low Frequency and Low Pitch, SB1– High Frequency and High Pitch, SB1– Low Frequency and High Pitch

Table-3: Reaction time with Sound Stimulation in males and females before and after coffee consumption

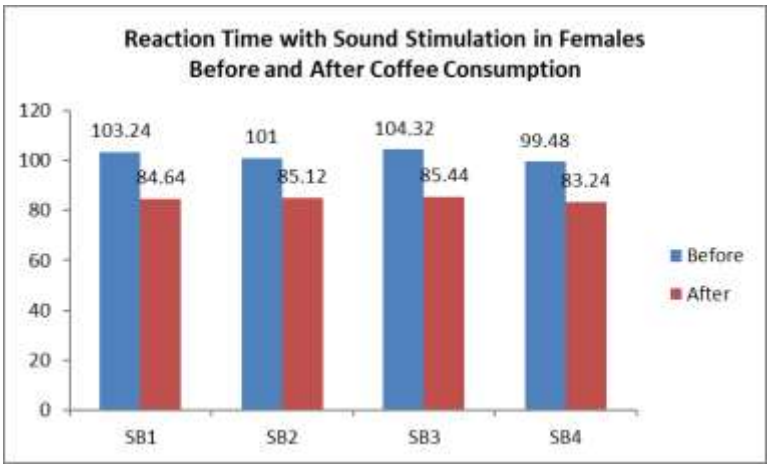
Sound Stimulus	Male (Mean ± SD)	Female (Mean ± SD)	"t" Value	"P" Value
SB1- Before	95.96 ± 18.97	103.24 ± 20.28	-1.310	.196
SB1- After	77.40 ± 14.12	84.64 ± 15.00	-1.757	.085
SB2- Before	99.32 ± 16.19	101.00 ± 16.81	-2.288	.027
SB2- After	76.40 ± 13.36	85.12 ± 15.94	-2.096	.041
SB3 - Before	94.32 ± 17.61	104.32 ±20.51	-1.849	.071
SB3-After	78.96 ± 17.11	85.44 ± 14.57	-1.452	.153
SB4-Before	95.28 ± 17.64	99.48 ± 19.07	-808	.423
SB4-After	75.60 ± 14.50	83.24 ±16.39	-1.745	.087

The result was statistically analysed by SPSS statistical analysis software and sample mean and standard deviations were tested for normality. The paired "t" test was applied to test the significance of standard deviation. 'P' values of <0.05 were considered statistically significant. p< 0.001 highly significant p< 0.05, significant p> 0.05, not significant.

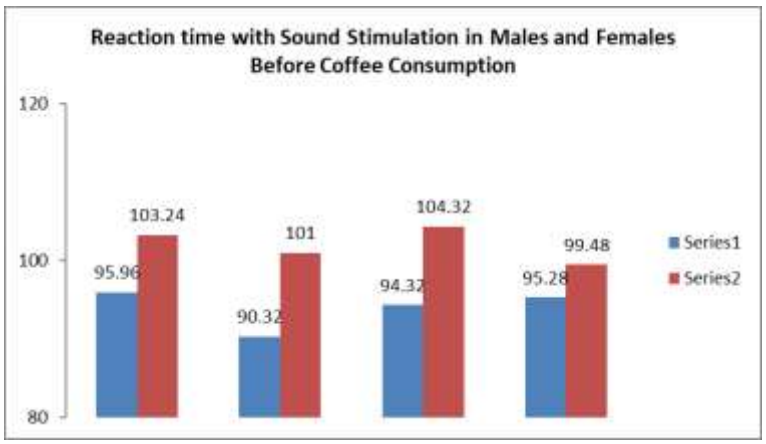
RESULTS



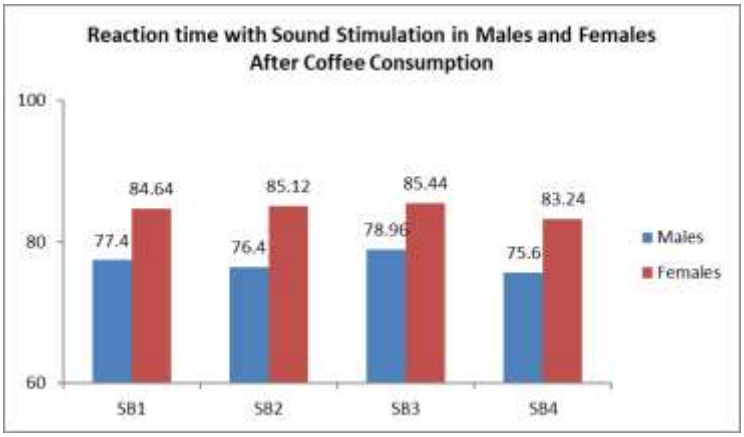
Graph-1



Graph-2



Graph-3



Graph-4

DISCUSSION

This study shows there was a significant decrease in RT after coffee consumption with auditory stimuli in both male and female undergraduate students (Table1, 2 and Graph 1, 2). This shows that caffeine present in coffee stimulate the nervous system which causes decrease in audio reaction time.

In this study there was no difference in Reaction Time (RT) before and after consumption of the coffee in both male and female healthy undergraduate students (Table 3 and Graph 3, 4). Noble *et al*. have observed that males have shorter RT than females and this difference remains ever after practice [16]. Similarly, Welford *et al*. Adam *et al*. Dane and Erzurumluoglu have also observed a shorter RT in makes than females [17].

CONCLUSION

The findings of this study, although limited by a small number of participants, show that ingestion of coffee 150 ml (caffeine) produces a significant decreased in reaction time, compared to before consumption of coffee (caffeine) in male and female healthy undergraduate students for auditory. No significant differences in auditory reaction times were observed between male and female healthy undergraduate students before and after coffee consumption.

REFERENCES

1. Roberts HR, Barone JJ. Biological effects of caffeine: history and use. Food Technology (USA). 1983.
2. Dixit A, Voney N, Tandon OP, Evaluation of cognitive brain functions in caffeine users: AP3 Evoked Potential Study. Indian J Physiol Pharmacol. 2006; 50(2):175-180.
3. Institute of food Technologist. Expert panel on food safety & Nutrition caffeine a scientific status summary. Food Technology. 1983:87-91.
4. Fredholm BB, Bättig K, Holmén J, Nehlig A, Zvartau EE. Actions of caffeine in the brain with special reference to factors that contribute to its widespread use. Pharmacological reviews. 1999 Mar 1;51(1):83-133.
5. Hewlett P, Smith A. Effects of repeated doses of caffeine on performance and alertness: new data and secondary analyses. Human Psychopharmacology: Clinical and Experimental. 2007 Aug;22(6):339-50.
6. Haskell CF, Kennedy DO, Wesnes KA, Scholey AB. Cognitive and mood improvements of caffeine in habitual consumers and habitual non-consumers of caffeine. Psychopharmacology. 2005 Jun 1;179(4):813-25.
7. Christopher G, Sutherland D, Smith A. Effects of caffeine in non-withdrawn volunteers. Human Psychopharmacology: Clinical and Experimental. 2005 Jan 1;20(1):47-53.
8. Baker WJ, Theologus GC. Effects of caffeine on visual monitoring. Journal of Applied Psychology. 1972 Oct;56(5):422.
9. Finnegan D. The health effects of stimulant drinks. Nutrition Bulletin. 2003 Jun;28(2):147-55.
10. Das S, Gandhi A, Mondal S. Effect of premenstrual stress on audiovisual reaction time and audiogram. Indian journal of physiology and pharmacology. 1997 Jan;41(1):67-70.
11. Jensen, A Clocking the mind. Mental Chronometry and individual differences, Amsterdam: Elsevier. 2006.
12. Der G, Deary IJ. Age and sex differences in reaction time in adulthood: results from the United Kingdom Health and Lifestyle Survey. Psychology and aging. 2006 Mar;21(1):62.
13. VenkateshD, Ramachandra DL, Baboo NS, Rajan BK. Impact of Psycological stress, gender and colour on visual response latency. Indian J PhysiolPharmacol. 2002 July 46(3): 333-7.
14. Welford AT, Choise reaction time: Basic concepts in AT, Welford (E d.), Reaction times. Academic Press, New York.1980; 73-128.
15. Lorist MM, Snel J. Caffeine effects on perceptual and motor processes. Electroencephalography and clinical neurophysiology. 1997 May 1;102(5):401-13.

16. Noble CE, Baker BL, Jones TA. Age and sex parameters in psychomotor learning. Perceptual and Motor skills. 1964 Dec;19(3):935-45.
17. Adam JF, Paas M, Buekers I, Wuyts W, Spijkers and P, Wallmeyer. Gender differences in choice reaction time: evidence for differential strategies. Ergonomics. 1999; 42:327.