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A Comparative Study on the Effect of Regular Intake of Caffeine on Hand Steadiness Test in Right Hand Dominant Females

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Abstract **Original Research Article**

Caffeine is a CNS stimulant affecting normal cellular functions and increase energetic metabolism throughout the brain by enhancing alertness. Steadiness Tester – 9 Holes measures one of the aspect of psychomotor phenomena of steadiness. Our study was done to find out the difference in hand steadiness between caffeine users and non -caffeine users. Our study was done on 60 subjects aged between 18-45 years. All the subjects were females. 30 subjects were included in group A as only caffeine users and 30 were Tee totaller acting as controls under Group B. consent was obtained from all the volunteers. All the subjects were tested on a standard laboratory 9 hole steadiness tester. Subjects were asked to hold a stylus in a series of holes decreasing from 12.5 mm to 2.5 mm without touching the sides of the holes. The number of contacts or errors during the test were noted. The results showed that group B were steadiest in comparison to Group A. Statistically significant differences was found in the hole 4 at $p< 0.05$ and highly statistical significant results obtained from holes 5 to 9 at $p\leq0.001$. Group B controls were steadier than Group A due to non-consumption of tobacco, alcohol, caffeine and any type of drug abuse.

Keywords: Caffeine, Hand Steadiness Test**,** Psychomotor, tee totaller.

INTRODUCTION

A cup of hot coffee early in the morning is a routine for many people across the world. It gives them a fresh feel to start a new day with zeal and enthusiasm. The active composition of coffee is caffeine. A cup of coffee contains 80–175 mg of caffeine. Caffeine is a CNS stimulant, it affects normal cellular function and increases energetic metabolism throughout the brain which produces alertness. Many therapeutical and physiological effects are based on amount of Caffeine consumed. Caffeine is used as an active ingredient in a variety of medicines such as analgesics, diuretics, weight loss and anti-allergic preparations**.** About 100–130 mg of Caffeine prescribed as pain relievers [1-3].

Steadiness Tester -Hole Type: This test measures one aspect of the psychomotor phenomena of steadiness which depends upon the combination of motor events of the body and the psychological processes.

AIMS & OBJECTIVES

To study the effect of regular intake of coffee on the hand steadiness of chronic coffee users and compare with tee totaller and to assess the impact of chronicity of coffee intake on the hand steadiness in chronic coffee users.

MATERIALS AND METHODS

Our study was conducted on 60 female subjects aged between 18-45 years the study subjects were divided into 2 groups; Group A [n=30] forms the coffee users and Group B [n=30] included tee totaller as controls. The study was carried out in department of Physiology IMSR for a duration of 1 year. Data was collected from volunteers after obtaining consent from the volunteers of the study. The institutional ethical committee approval was obtained.

Inclusion Criteria

Apparently 60 healthy right hand dominant female subjects aged between 18-35 years, with no upper limb injury and no psychiatric disorder affecting psychomotor abilities were selected in general. Subjects with no history of disease and drug abuse that might affect steadiness were selected. Subjects were instructed to have an adequate sleep on the previous night before the test and should not perform any physically

exhausted task. **Group A** comprised of 30 female subjects consuming only caffeine more than 2 cups per day for more than 2 years and were non-alcoholics and non-smokers and non-tea drinkers. **Group B** subjects were 30 female tee totaller.

Exclusion criteria

All male subjects were excluded. Female subjects below 18 years and above 45 years were excluded from our study. Patients suffering from any disease like thyroid disorders, Parkinson's disease, hand deformities, smokers, tea consumers, alcoholics etc were also excluded from the study.

Apparatus

A standard steadiness tester (Medicaid ST-320) was used. The apparatus has 9 holes and a test surface at an angle of 45^{o} to the horizontal. All holes are spaced 1.5cms apart arranged in 2 rows. Diameters for holes 1-9 were 12.5, 8.0, 6.5, 5.0, 4.5, 4.0, 3.5, 3.0 and 2.5 mm respectively. A stylus resembles a pencil. Stylus has a handle of 11.5 cm and an attached 4.8 cm stainless steel probe of 1mm diameter. When the probe touched the sides of the hole a circuit was closed, activating an auditory signal generator that provided feedback to the subjects. Apparatus was under the control of computer such that for each trial kept the track of the number of touches and of the total time the probe was in contact with the side of a hole. An adjustable table was used to position the apparatus at each subject's shoulder height and at arm's length to the second joint of the middle finger.

Procedure

All the subjects performed the test one after another in a well-ventilated and well illuminated room after getting well versed with the instrument. The apparatus was placed on a wooden table whose height could be adjusted so that the top of the apparatus was at shoulder height and its outer edge was in line with the edge of the shoulder of the dominant arm. Subject is instructed to hold a stylus in each of the nine holes without touching the sides or the base plate. An audible tone and visual red indicator provided responses and immediate feedback of performance. Subject's total score was calculated based on the number of errors committed during the entire task. Each participant was given 3 turns, at the end of which, the best score out of the three was used. The data was expressed as mean and standard deviation. It was stored in excel sheet and statistical analysis was done by SPSS 21.0 version using student's unpaired test. P value less than 0.05 was considered statistically significant and P value less than 0.001 was considered highly statistically significant.

RESULTS

Table 1: Age wise distribution of the subjects

Age [years]	Group A [n=30]	Group B [n=30]
18-30	68%	49%
31-45	32%	51%

Table 1 shows that in our study subjects were aged between 18-45 years and majority of our group A subjects were between age group 18-30 years while in group B the majority of subjects were aged between 31-45 years.

Table 2: Number of errors noted in each hole of hand steadiness apparatus

Hole	Group A [n=30]	Group B [n=30]	P value
1	01.30±0.16	01.22±0.14	NS
2	03.34±1.52	02.14±0.59	NS
3	29.35±8.92	25.49±9.05	NS
4	40.47±3.49	39.10±4.05	0.034*
5	112.50±6.48	97.89±7.89	0.001**
6	175.32±11.12	226.12±12.78	0.001**
7	213.51±25.62	192.54±30.93	0.001**
8	481.48±21.08	366.25±18.15	0.001**
9	518.26±18.21	467.21±21.05	0.001**

Data is expressed as Mean ± S.D, *p<0.05; **p<0.01 is considered statistically significant.

In table 2 we have observed that there is no statistically significant results in holes 1, 2 and 3. The fourth hole shows p value <0.05 [0.034] which is statistically significant. A highly significant value p<0.001 was obtained in holes starting from 5^{th} hole to 9^{th} hole.

DISCUSSION

Steadiness is an important component of skills. The ability of a person to hold the hand in a specific position for an interval of time is known as hand Steadiness. It is a psychomotor phenomenon which depends upon the combination of motor events of the body and the psychological processes like the mental

ability to concentrate on the target in case of archery, shooting or aiming. Gender is one of the factor that has conflicting literature on the hand steadiness of a person, so to avoid the gender bias our study included only females as study participants. There is less prevalence of alcohol or drug abuse of any sort in Indian female population as these things bear a social stigma. Other factors that influence hand steadiness include a person's age, physical built, position of the subject while performing test [4]**,** mental status [mental well-being, anxiety, depression, lack of concentration or disturbance of sleep-wake cycle], consciousness to perform better and drugs like central nervous system stimulants or depressants, hormones. Tobacco, alcohol, caffeine consumed in any form affect the hand steadiness. These substances when consumed in high doses or taken regularly for many years will result in the deterioration of psychomotor performances. One such side effect is development of gross to fine hand tremors**.**

There is a lot of literature and research on caffeine. Altimari *et al*., [5] in one study reveals that there is variation in effect of caffeine from person to person, based on amount, frequency and its regularity in intake of caffeine. Chronic intake of 100 mg/day of caffeine which is equal to approximately one and a half cups of 150 ml instant coffee can cause habituation of caffeine [6].

There are numerous effects of caffeine on human body. In the autonomic nervous system, the neurotransmitter adenosine decreases heart rate, blood pressure and body temperature. Caffeine is known to produce an inhibitory action on adenosine receptors, present in nerve cells. Many physiological responses to caffeine administration are opposite to adenosine, so there is a feeling of re-energizing, decreased sleep, and fatigue. Caffeine has an effect on the release of other neurotransmitters and hormones, like adrenaline.

When an individual consumes caffeine at normal dose, it has an effect on learning and memory. Caffeine in many research is mentioned as a substance which improves short term memory, concentration, alertness, motor co-ordination, decreases reaction time, helps to maintain mental acuity and decreases cognitive deterioration in geriatric people. The effect of caffeine varies depending on amount of caffeine consumed and the individual anthropometric measurement and degree of tolerance [7].

The effect caffeine starts approximately within 1 hour after its consumption and subsides in about 3 -4 hours [8]. Caffeine has psychoactive effects that promote attention and task switching are most pronounced during the first hour of caffeine intake [9]. Caffeine in moderate doses about 5mg/Kg improves task performance and delays the onset of fatigue [10-12]. In our study where the group A subjects were consuming coffee regularly showed more number of errors in comparison to group B tee totallers. This finding may be due to chronic consumption of caffeine which causes fine tremors in hand. The errors were increasing in number as the stylus moved from hole 1 to hole 9. Elan D Louis in his study revealed that caffeine can exacerbate tremor, reducing caffeine intake or switching to decaffeinated beverages can lessen tremor [13].

CONCLUSION

In our present study initial efforts were put to observe the effects of caffeine intake on hand steadiness that affects cognitive functions and may negatively affect their task performance. The tee totaller were steadier in performing the allotted task. Subjects who performed poor were identified and educated them to deal effectively with the adverse effects of caffeine intake. When we conducted this study, we informed all the subjects about pros and cons of caffeine consumption.

LIMITATIONS OF OUR STUDY

Study should be done for a long tenure on large sample size eliminating the confounding factors to confirm the validity of results obtained on small sample size.

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