Global Journal of Applied, Management and Social Sciences (GOJAMSS); Vol.15, June 2018; P.81 – 89 (ISSN: 2276 – 9013)

INFLUENCE OF CAFFEINATED SUBSTANCE ON SLEEP INHIBITION AND MENTAL ALERTNESS AMONG UNDERGRADUATES

OKENYI OKWUNWA SABINA
Department of psychology
Enugu State University of Science and Technology.
+2347032747155
E-mail – sabinaokenyi@gmail.com

&

EZE EMMANUEL IFEANYI
Department of Mass Communication
University of Nigeria Nsukka
+2348033594457
E-mail – emmanuelezeifeanyi@gmail.com

&

OKENYI NWABUNWANNE JOSEPH
Department of Animal Science
University of Nigeria Nsukka
+2347030815709
E-mail – okenyijoseph4real@gmail.com

Abstract
This experiment investigated the influence of caffeinated substance on sleep inhibition and mental alertness among undergraduates. Participants were selected using Pittsburgh sleep quality scale (PQSI) and were randomly assigned to the experimental and control conditions. The experimental group ingested 200mg of caffeinated coffee while the control group ingested 200mg of decaffeinated coffee. Following this, participants subjectively given sleepiness and mental alertness using the Stanford sleepless scale (SSS) and the United States Air force school of Aerospace medicine (USAFSAM) mental fatigue. Using MANOVA, the results showed that caffeinated substance effectively inhibited sleep and induced mental alertness without gender differences on caffeinated substance.

Key words:- *caffeinated substance, sleep inhibition, mental alertness.*

INTRODUCTION

It has become conventional to talk about caffeine because people have formed the habit of taking it as a supplement that makes them to have been implicated in various studied as regards emitting certain behaviours, specifically sleep and mental alertness. In most cases various researches have made startling revelations about the effects of caffeine on sleep and mental alertness. Coffee, nicotine and kolanut are socially accepted drugs in many countries and their consumptions are practiced worldwide. Drugs acting on central nervous system (CNS) are the most widely used group of pharmacological active agents and have extremely important psychological uses. psychological effects of caffeine are biphasic. Low doses produce stimulation, which are often perceived as desirable, whereas high doses can cause the unpleasant effects of caffeinism (Daily & Fredholm, 1998). Caffeine increased mental alertness, reduces fatigue and can elevate mood (Leinart & Hubber, 1966; Roger & Devnoncourt, 1997; Smith, 2002). Normal consumption improves performance on tasks that required alertness, such as stimulated driving tasks (Smith, 2002).

Nescafe, a product that has a high concentration of caffeine, is commonly abused by Nigerian students, those who wish to stay awake and study are most likely to do this (Eze & Omeje, 1999). Most people do not regard coffee and kolanut as drugs.

The long standing popularity of beverage and substances that naturally contain caffeine attest to its appealing qualities. Because caffeine consumption is so widespread it is one of the most well studied ingredients in food supply. According to Griffiths & Mumford (1995) the widespread use of culturally sanctioned caffeine containing foods present an intriguing paradox. On the one hand, it is the experiences of most regular caffeine users that caffeine products rather subtle effects that are generally so well woven into the fabric of daily experiences that such effect are not clearly differentiated from the changes in mood and behaviour associated with normal experience. On the other hand, caffeine is arguably the most robust form of self- administered drug known to man. Throughout history, caffeine has intermittently been labeled as a drug of abuse and analogies have been made to classic abused substances. This suggestion seems to be usually controversial and is rebutted with the following observations. Caffeine use is consistent with socially accepted limits and patterns of gross over consumption of any article of diet can be harmful, and the adverse effects of excessive intake seem to be transient. It s this paradox of seemingly subtle pharmacological effects juxtaposed against its robustness as a self-administered drug that makes caffeine among the most intriguing substances for research into behavioural pharmacological mechanisms underlying the habitual use of drugs generally, and possibly drugs of abuse in particular.

Caffeine is one of the most used stimulants. It is consumed throughout the world (Tarmopolsky, 1994). Short-term consumption has a lot of effect on human physiology, including sleep. Caffeine apparently affects the psychological state of those who consume it. Abuse result in symptoms of caffeinism, which include agitation, disorientation, and a syndrome, which may be mistaken for anxiety neurosis (Benowitz, 1990). It is a habit forming drug of which tolerance develops. It affects sleep in a dose- related manner, which is dependent on the daily caffeine intake (Bolton & Null, 1981). Bolton & Null (1981) also opined that at lower levels or doses, caffeine has pleasant effects on attention and concentration, which are both aspect of mental alertness; caffeine is used as a food additive and as a drug or a component of many pharmaceutical preparations. It is most widely consumed as psychoactive or central nervous system (C.N.S) stimulant in the world (Curatolo & Robertson, 1983). It is readily available to both the civilian and military populations as a beverage (coffee, tea, mate), food (cocoa products), food additives (soft drinks), and pharmaceutical medicines (over-the counter pain, weight-loss, sleep-loss medications; and numerous prescription drugs). No other drug or substance has this combination of uses (Terass, 2002).

Sleep inhibition is a phenomenon whereby sleep is hampered, stopped, lost, blocked or hindered even in the face of imminent sleep (Bremer, 1977). Everyday observations seem to show that people use caffeine to keep awake which by implication suggest that it inhibits sleep (Bolton & Null 1981).

Sleep inhibition means staying awake. When the alerting area of the brain is most active, they inhibit activity in other areas of the brain responsible for promoting sleep. This inhibition of sleep results in stable wakefulness (Saper, Chou & Scammell 2001).

Mental alertness encompasses a wide spectrum of cognitive functions such as reaction time, vigilant behaviours, problem solving, decision-making, heightened concentration and attention, marked accuracy, target identification, sustained short term memory etc these constellation of mental activities spell out areas of caffeine interference, resulting in remarkable positive changes (Dealth wood & Pollet, 1982).

Mental alertness is any function pertaining to the mind such as awareness, perception imagination, reasons etc.

LITERATURE REVIEW

Sleep inhibition and caffeine.

In 1937, Bremer summarized his work and proposed the hypothesis that sleep does not result from an inhibition of the brain but from a cerebra deactivation by a decrease of "cortical tone", measuring that when "cortical tone" is increased, wakefulness results. This proposition was supported by Crasilneck & Hall (1985) in that they posited that a generalized cortical inhibition brings forth sleep while activation tantamount to wakefulness. Wakefulness is maintained by continuous sensory input to the brain. Based on this, Bremer & Cerveau (1935) isolated the brain of a cat through mesencephalic transaction in his famous experimental preparation called "Cerveau Isole" and found that his "cerveau Isole" preparation produced a state indistinguishable from physiological sleep, with slow cortical waves and miotic pupils. Bremer (1935) revealed that an "encephale Isole" cat showed alternations of sleep and wakefulness. This shows that an inhibition of the activities of the brain especially the precortical region results in sleep, and when activated by any mechanism result in wakefulness or sleep inhibition.

A number of studies have shown that caffeine increase sleep latency (Zwyghuizen- Doorenbos, Loehrs, Lepschicts, Timms&Roth 1990) and reduce sleep duration (Hicks, Reyes & Chers, 1983). Caffeine often produces its effects by increasing latencies in the first half of the night (Bonnet & Webb, 1979) .

They are large individual difference in the effects of caffeine on sleep. For example, one study has shown that even caffeine given in the early morning could influence the subsequent night's sleep (Landdolt, Werth, Barbely & Dijk, 1995), whereas other individuals report that they can consume caffeine-containing beverages before bedtime with no adverse impact on their sleep. Indeed, other results suggest that tolerance develops as to effect of caffeine on sleep (Zwyhuizen- Doorenbos, Rorhrs Lepschiet, Timms & Roth, 1990) but that there are no withdrawal effects, on sleep when caffeine is no longer given (Searles, 1994).

Mental Alertness and Caffeine

IOM (2001) reported that common experience and results of scientific investigations support to belief that caffeine enhances performance on a variety of cognitive and mental tasks, Jarvis (1993) reported that there was a highly significant dose- response relationship between habitual caffeine intake and psychomotor performance. This report also clearly demonstrated that tolerance to the performance enhancing effects of caffeine, if it occurred make consumers perform better than non- consumers on mental alertness or vigilance tests (Jarvis, 1993). Additionally, Zwyhuizen- Doorenbos, Roehrs, Lipschietz, Timms & Roth (1990) demonstrated that caffeine compared to Placebo, improved daytime alertness and reaction time on auditory vigilance task. Amendola, Gabriel & Lieberman (1998) reported that caffeine at various dose- levels enhanced accuracy and reduced reaction time on auditory and visual vigilance tasks.

Amendola, Gabriel & Lieberman (1998) reported that caffeine at various dose-levels enhanced accuracy and reduced reaction time on auditory and visual vigilance tasks. Moreover, caffeine significantly increased self-report of vigour and decreased reports of fatigue. Self- report of energy levels was also improved by caffeine (Lieberman, Wurtman, Emde, Roberts & Coviella, 1987; Sicard, Derault, Enslen, Chauffard, Vandel & Tachon, 1996). However, caffeine did not improve long-term memory, false alarms in an auditory vigilance tasks, and motor coordination. in a military situation involving a tedious task that required sustained attention for proficient performance (Sentry duty), caffeine eliminated the vigilance decrement that occurred with increasing time on duty, reduced subjective reports of tiredness, and did not impair rifle firing accuracy (Johnson, 1999).

Caffeine Use and Gender Differences

A number of studies have report on the effects of caffeine on gender physiology and cognitive responses. Typically, males consume slightly more caffeine than females (IOM, 2001). Kamimari Joubert, Offers letter, Santoroman & Eddinton (1999) observed from limited data available gender does not appear to play a role in the effects of caffeine on sleep inhibition and mental alertness.

Hypotheses

1. There will be no statically significant effect of caffeine on sleep inhibition.
2. There will be no statistically significant at effect of caffeine on mental alertness.
3. There will be no statistically significant gender different of caffeine effect on sleep inhibition.
4. There will be no statistically significant gender difference of caffeine effect on mental alertness.

METHOD

Eighty (80) participants, 40 males and 40 females, were drawn from the department of political sciences, Enugu state University of Science and Technology Enugu, after the researcher's selection with those who were qualified by the pittsburgh sleep quality index scale (PSQI) which was used.

Procedurally, it was technical that half of the participants the control group which were made up of males and females took a standard dose of 200mg of decaffeinated coffee and experimental group which were also half of the participants (males and females) took a standard dose of 200mg of caffeinated coffee which were served hot for easier diffusion. The participants both the control and the experimental groups were given Stanford sleepiness scale and United States Air force school of Aerospace medicine of mental fatigue questionnaire.

Pittsburgh sleep quality index:- (PSQI) is a 9- question, self-report instrument designed to measure sleep quality and disturbance over a 1-month period. It was developed by Buysee, in 1989.

Pearson product moment correlation statistics was used to test the reliability, an r of .80 was obtained. Thus instrument passed the face and content validity.

Stanford sleepiness scale (SSS) is a great way to quickly assess how sleepy one is feeling. It was developed by Stanford in 1980. The consistence overtime obtained was r= 0.83. Validation of the instruments has done by a medical doctor and a clinical psychologist who approved the instrument as measuring what is set out to measure.

United state Air force school of Aerospace medicine mental fatigue (USAFSAM) is 7 – point mental attitude scale. It was developed by air crew men in 1964. Pearson product moment correlation statistics was used to test the reliability of the instrument, an r of 0.82 was obtained.

Design: Randomized factorial design.
Statistics: multivariate Analysis of variance (MANOVA) was used.

RESULT
Table 1: Pair Wise comparison

Dependent variables	Caffeine and gender	Caffeine and gender	Mean differences	Std. error
Sleep inhibition	1.1-male caffeinated	1.2-male decaffeinated 2.1 female caffeinate 2.2- female decaffeinated	-3.250 -.150 -3.400	.281 .281 .281
	1.2-male decaffeinated	1.2-male decaffeinated 2.1 female caffeinate 2.2- female decaffeinated	-3.250 -.150 -3.400	.281 .281 .281
	2.1-female caffeinated	1.2-male caffeinated 2.1 male caffeinate 2.2- female decaffeinated	-150 -.3.100 -3.250	.281 .281 .281
	2.2-female decaffeinated	1.1-male caffeinated 1.2 male decaffeinate 2.1- female caffeinated	-3.400 -.150 -3.250	.281 .281 .281

Based on estimated marginal means
The mean difference is significant .05 levels.
Table 2: Pairwise comparison

Dependent variables	Caffeine and gender	Caffeine and gender		95% confidences internal for differences
			Sig.[a]	Lower bound
Sleep inhibition	1.1-male caffeinated	1.2-male decaffeinated 2.1 female caffeinate 2.2- female decaffeinated	.000 .595 .000	-3.810 -710 -3.960
	1.2-male decaffeinated	1.1-male caffeinated 2.1 female caffeinate 2.2- female decaffeinated	.000 .000 .595	2.690 2.540 -.710
	2.1-female caffeinated	1.1-male decaffeinated 2.1 male decaffeinate 2.2- female decaffeinated	.595 .000 .000	-410 -3.660 -3.810
	2.2-female caffeinated	1.1-male caffeinated 1.2 male decaffeinate 2.1- female caffeinated	.000 .595 .000	2.840 -410 2.690

Based on estimated marginal means.

Table 1 and 2 are tables of pairwise
Comparison means score for the different levels and their effects on

- Table 1 shows a comparision between male caffeinated and male decaffeinated with a mean difference of -3.250 (table 1) which is significant at P< .001 level.
- A comparision between male caffeinated and female caffeinated reveals a mean differences of -150 (table 1) which is not significant P = .595 (table 2).
- Male caffeinated and female decaffeinated has a mean difference of -3.400 (table 1) which is significant at P< .001 (table 2).

In the second row of table 1, the mean of male decaffeinated was compared with that of other levels means, and the result showed the following:

- Male decaffeinated and male caffeinated has a mean difference of 3,250 (table 6) and is significant at P< 001 (table 7).
- Male decaffeinated and female caffeinated has a means different of 3.100, this difference is significant at P<.001 level,
- Male decaffeinated and female decaffeinated has a mean difference of -150, which is not significant at P= .595 level (table 2).
- The third row of table 1shows the mean differences and significant levels of female caffeinated and the other three levels means and the result revealed the followings:
- Female caffeinated and male caffeinated revealed a mean differences of -150 which is not significant at P = .595 level (table 2).
- Female caffeinated and male decaffeinated has a mean difference of -3.100 (table 1) and is significant at P< .001 level (table 2).

Female caffeinated and female decaffeinated has a means difference of -3.250 (Table 2) and is significant at P< .001 level.

- The fourth row table 1, shows the mean difference and significant level of the female decaffeinated and that of the other three levels as follows.
- Female decaffeinated and male caffeinated has a mean difference of 3.400 (table 1), which is significant at P< .001 level (table 2).
- Female decaffeinated and male decaffeinated has a mean difference of -.150 which is not significant at P= .595 level (table 2).
- Female decaffeinated and female caffeinated has a mean score of 3.250 which is significant P< 001 level.

Table 3 Pair Wise comparison

Dependent variable	Caffeine and gender	Caffeine and gender	Mean differences	Std. error
mental alertness	1.1-male caffeinated	1.2-male decaffeinated 2.1 female caffeinate 2.2- female decaffeinated	-3.400 -.150 -3.400	.281 .281 .281
	1.2-male decaffeinated	1.1-male decaffeinated 2.1 female caffeinate 2.2- female decaffeinated	-3.400 -.150 -9.021	.281 .281 .281
	2.1-female caffeinated	1.1-male caffeinated 2.1 male caffeinate 2.2- female decaffeinated	-150 -.3.250 -3.250	.281 .281 .281
	2.2-female decaffeinated	1.1-male decaffeinated 2.1 male decaffeinate 2.1- female caffeinated	-3.400 9.021 -3.250	.281 .281 .281

Based on estimated marginal means
The mean difference is significant at the .05 level.

Table 4 Pair Wise comparison

Dependent variable	Caffeine and gender	Caffeine and gender	sign [a]	Lower bound
mental alertness	1.1-male caffeinated	1.2-male decaffeinated 2.1 female caffeinate 2.2- female decaffeinated	.000 .595 .000	-3.950 -710 -3.960
	1.2-male decaffeinated	1.1-male decaffeinated 2.1 female caffeinate 2.2- female decaffeinated	.000 .000 1.000	2.840 2.690 -.560
	2.1-female caffeinated	1.1-male caffeinated 1.2 male caffeinate 2.2- female decaffeinated	.595 .000 .000	-410 -3.810 -3.810
	2.2-female decaffeinated	1.1-male caffeinated 1.2 male caffeinate 2.1- female caffeinated	.000 1.000 .000	2.840 -560 2.690

Based on estimated marginal means

Table 3 and 4 are tables of pairwise comparision showing mean differences of the differences levels and their levels of significant for mental alertness.

- Male caffeinated and male decaffeinated have a mean difference of -3.400 (table 3) and is very significant at P< .001 level (table 3).
- Male caffeinated and female caffeinated has a mean difference of -.150 and is not significant at P= .595 level.
- Male caffeinated and female decaffeinated has a difference of -3.400 which is highly significant at P< .001 level (table 4).

The second row of tables of 3 and 4 shows the followings:

- Male decaffeinated and male caffeinated have a mean difference of 3.400 and this is very significant at P<.001 (table 4).
- Male decaffeinated and female caffeinated has a mean difference of 3.250 and is significant at P<.001.
- Male decaffeinated and female decaffeinated has a difference of -9.021 and is not significant at P = 1.000 level (table 4)

The third rows and columns of both tables shows the followings:

- Female caffeinated and male caffeinated mean difference is .150 which is not significant at P= 595 levels.
- Female caffeinated ad male decaffeinated mean difference is = -3.250 which is significant at P<.001 level (table 4).
- Female caffeinated and female decaffeinated mean difference is -3.250 which is also significant at P<.001 level.

The fourth rows and column of table 3 and 4 shows the followings:

- Female decaffeinated and male caffeinated mean difference is = 3.400 which is significant at P<.001 level.
- Female decaffeinated and male decaffeinated difference mean is 9.021 which is not significant at P= 1.000 level.
- Female decaffeinated and female caffeinated mean differences is = 3.250 which is significant at P<.001 level.

DISCUSSION OF THE RESULT

The findings showed emphatically that caffeinated coffee contributed immensely and effectively in inhibiting sleep and inducing mental alertness.

However, the hypothesis, 1 and 2 which stated that there will be no statically significant effect of caffeine on sleep inhibition and mental alertness, therefore based on the findings they were rejected.

Moreover, the hypothesis, 3 and 4 which stated that there will be no statistically significance gender differences of caffeine effect on sleep inhibition and mental alertness, therefore based on the findings they were accepted.

IMPLICATIONS OF THE STUDY

The findings of the research in many respects have added to our knowledge concerning the influences of caffeinated substance on inhibiting sleep and inducing mental alertness.

Indeed, doctors are encouraged to drink low dose of caffeine during their surgical duties as it was then proven that caffeine boosted their brain power and kept their body and memory fit for more mental work. Students are also encouraged to drink low dose of caffeine during their examinations.

LIMITATIONS OF THE STUDY

The scope of the study is one major pitfall, which arose in the course of the experiment. The researcher could not extend the area of coverage of the study to involve undergraduates in other universities because of time factor and moreover, lack of fund.

SUGGESTIONS FOR FURTHER RESEARCH

The scope of the study should be widened to include undergraduates of other institutions. The selection of more participants should be encouraged, so as to make broad generalizations much more dependable.

RECOMMEDATIONS:

Since Caffeine has been proved to be a stimulant which keeps people awake, security agencies are hereby directed to be using caffeine during their different tasks which will help them to perform their duties perfectly in the night. There is need for government to reduce the high price of caffeine so that students can afford them and use them during their examinations.

CONCLUSION

In the study of the influence of caffeinated substance on sleep inhibition and mental alertness among undergraduates, the researcher found that caffeinated coffee was statistically significant in inhibiting sleep and inducing mental alertness in normal (good sleeper) undergraduates in the department of political Science, Enugu state university of science and technology.

References

Amendola, C., A., Gabriel, J.,O.E., & Lieberman, H;R. (1998) . Caffeine effect on performance and mood are department of age and gender. *Nur.NeuroSci 1,269-280.*

Benowite, N.L. (1990) Clinical pharmacology of caffeine. *Annual review Medi,* 41, 277- 288.

Bolton, S & Null, G. (1981). Caffeine psychological Effect, Use and Abuse. Ortho molecular psychiatry, volume to 3, 202 -211.

Bonnet, M.H., Webb, O. (1979). The use of caffeine versus prophylactic naps in sustained performance. Sleep 18, 97-104.

Bremer, F. (1935) Cerveau "Isole" et physiologic du sommeil CR Soc. Biol, 118, 1235- 1241.

Bremert, T. (1977).Cerebral hypoxemic centers *Ann Neural. 2,1-6*

Buysee, D., J., Reynolds II C.F., Mond, J., H., Berman, S., R &Kupfor, D.J., (1989). The Pittsburgh sleep quality index- 9 new instrument for psychiatric practice and research. *Psychiatric Research,* 28, 193-213.

Curatolo, P.W. & Robberstson, C. (1983). The Health consequence of caffeine: *Review. Ann. Interm.* Med, 98,641-653.

Eze, J, E &OMeje, O. (1999). *Fundamentals of substance abuse*, snap press LTD.

Griffiths, R.R & Mumford, K.G. (1995). Caffeine- a drug of abuse? In E.F. Bloom & J.D. Kuffer (Eds), *psychopharmacology.* The fourth generation of progress (1699-1713). New York Raven Press.

Hicks, R., A., Reyes, J.R., & Chars, Y. (1983).Daily caffeine use and the sleep of college students.*Bulletin of the psychonomic society* 21, 24-25.

Institute of Medicine (IOM), (2001), caffeine for the sustainment of mental task performance formulations for military operations, washing, trc: National Academy press.

Jarvis, M., J. (1993). Does caffeine intake enhance levels of cognitive performance? Psychopharmacology, 110, 45-52.

Kamimari, G., H., Joubert, A., Offer-sleffer, R., Santaromana, M.&Eddington, N.,D., (1999). The effect of menstrual cycle on the pharmaco kinetics of caffeine in normal, healthy eumenorrheic females.*Eur.I. Clinpharmacol. 55, 445- 449.*

Landolt, H., P., Worth, E., Barbely, A., &Dijk, D., T. (1995). Caffeine INTAKE (200MG) in the morning affects human sleep and power spectra at night. *Brain research*675,67-74.

Leathwood, P.D, Pollet, P. (1982). Diet- Induced mood, changes in normal populations. *Journal of psychiatric research* 17, 144-154.

Liebierman, H.R. Wurtman, R.J Emde, G.G., Roberts, C. & Coviella, I.L.G. (1987). Effects of low do of caffeine on human performance and mood. *Pschopharmacology,* 92, 308-312.

Lienart, G.A., & Hubber, H.P. (1966) Differential effects of coffee on speed and power tests. *Journal of psycho.* 63269- 274.

Rogers, P.J., Richardson, N.J & Dermoncourt, C. (1995). Caffeine use: Is there a net benefit for mood and psychomotor performance? *Neurophysiology* 31- 195- 199.

Saper, C.B. Chou, TC & Scammell, T.E. (2001). The sleep switch hypothalamic control of sleep and wakefulness. Trends in neuroscience 24: 726- 31.

Searles, G.F. (1994). The effect of dietary caffeine manipulations on blood caffeine, sleep and disturbed behavior *Journal of intellectual disability the research*38,383-391.

Smith, A. (2002). Effects of caffeine on human behaviour food and chemical Toxicology, 40, 1243- 125.

Tarnopolsky, M.A. (1994). Caffeine and endurance performance *Sport med.,* 18(2), 109-125.

Zwyghuizen- Doorenbos, A., Roehrs, T. A., Lipschietz, L., Timms, V., & Roth, T. (1990).*Effect of caffeine in Alertness psychopharmacology,* 100,30-39.