

EFFECT OF CAFFEINE (COFFEE) ON BLINK RATES OF ADULTS.

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DEPARTMENT OF OPTOMETRY

FACULTY OF LIFE SCIENCES

UNIVERSITY OF BENIN

BENIN CITY

APRIL, 2024

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**A RESEARCH PROJECT SUBMITTED TO THE DEPARTMENT OF OPTOMETRY,
FACULTY OF LIFE SCIENCES, UNIVERSITY OF BENIN, BENIN CITY, IN PARTIAL
FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF
OPTOMETRY (O.D) DEGREE IN OPTOMETRY.**

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CERTIFICATION AND APPROVAL

DEDICATION

I dedicate this project work to God Almighty, My amazing Mother, **Mrs. Alice Lynda Osifo** and myself for not giving up throughout this course of study.

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ABSTRACT

Caffeine is a stimulant, which means it increases activity in the brain and nervous system. It also increases the circulation of chemicals such as cortisol and adrenaline in the body. Caffeine is naturally found in the leaves and fruits of some plants. It is in coffee, black and green tea, cocoa, cola soft drinks and energy drinks. Blinking has been described to occur voluntarily, reflexively or spontaneously. Caffeine is a known stimulant that affects nervous system and probably the most widely consumed psychoactive substance is claimed to have conflicting effects on blink rate and blinking plays a critical role in the health of the eye. This research has assess the influence of caffeinated coffee consumption with blink rate. The purpose of this study was to determine the effect of caffeine intake(coffee) on blink rate.The blink rate was measured on a sample of 85 participants in the university of Benin Optometry teaching clinic.The measurements for the test per participants were obtained and afterwards the means were applied in analysis of the result. Mean baseline was 17.38 and the mean blink rates after caffeine consumption was 15.04, 13.91, 12.42, and 16.69 for 15, 30, 45 and 65 minutes respectively. There was a statistically significant reduction in the blink rate of participants after the consumption of caffeine ($p < 0.05$). It was concluded that caffeine reduces blink rate in adults and excessive intake of caffeine should be avoided since caffeine intake could cause improper functioning of the eye.

Keywords: Caffeine, blink rates, Nervous system, coffee.

CHAPTER ONE

1.0. INTRODUCTION

Every day, millions consume caffeine to increase wakefulness, alleviate fatigue, and improve concentration and focus. Amid myths and controversy about whether caffeine is good or bad for us, evidence suggests that moderate coffee consumption can bring both benefits and risks.

However, a high consumption of caffeine may not be healthful. In addition, the recent trend of adding caffeine to drinks and snacks that do not naturally contain it has raised new concerns. Caffeine is a stimulant that occurs naturally in some foods. The Food and Drug Administration (FDA) recommends a maximum intake of 400 mg a day, or two to three cups of coffee. A moderate intake of coffee may enhance weight loss, cognitive function, and alertness. Caffeine may have a negative impact on pregnancy, fertility, glucose control, and other aspects of health. Energy drinks can contain high levels of caffeine but are unlikely to be hazardous unless consumed with alcohol. Caffeine powder can lead to a fatal overdose and should be avoided.

SOURCES OF CAFFEINE

Caffeine occurs naturally in the leaves, seeds, or fruit of more than 60 plant species, including:

- coffee beans
- tea leaves and buds
- kola nuts
- cacao beans
- guarana seeds
- yerba mate leaf

Caffeine in plants acts as a natural pesticide. It paralyzes and kills insects that attempt to feed on them. Caffeine features in tea, coffee, and chocolate, and it is regularly added to gum, jelly beans, waffles, water, syrup, marshmallows, sunflower seeds, and other snacks.

The FDA recommends that healthy adults limit their caffeine intake to a maximum of 400 milligrams (mg) a day, about 4 or 5 cups of coffee. This amount is not associated with negative effects. There is no set limit for children, but the American Academy of Pediatrics (AAP) discourages the consumption of caffeine and other stimulants by children and adolescents.

BENEFITS OF CAFFEINE

Caffeine may have some health benefits, but not all of these have been confirmed by research.

1. **WEIGHT LOSS** : Caffeine may boost weight loss or prevent weight gain, possibly by:

- suppressing the appetite and temporarily reducing the desire to eat
- stimulating thermogenesis, so the body generates more heat and energy from digesting food
- Weight loss products that are marketed as thermogenics may contain caffeine and ephedra, or ephedrine.

Research has not confirmed long-term results.

2. **SPORT PERFORMANCE**: Caffeine can improve physical performance during endurance exercise. The European Food Safety Agency (EFSA) recognize that caffeine can increase endurance performance, endurance capacity, and reduction in perceived exertion. However, the effects on short-term, high-intensity exercise remain inconclusive.

3. **BRAIN FUNCTION:** Caffeine affects adenosine receptors in the brain. Coffee also contains polyphenol antioxidants, and these, too, act on various pathways. Studies have suggested that drinking coffee may help enhance some thinking skills and slow the mental decline that comes with age. However, more research is needed to confirm this.

4. **ALERTNESS:** A 75-mg serving of caffeine can increase attention and alertness, and a 160 to 600-mg dose may improve mental alertness, speed reasoning, and memory. However, caffeine is not a substitute for sleep.

1.1 BACKGROUND OF THE STUDY

Human caffeine consumption has been a part of everyday culture in several continents since at least the fifteenth century. In modern society, caffeine has become one of the most widely used dietary constituents, consumed daily by more than 70-80% of the population in Western countries. The average daily caffeine intake varies from country to country, but it has been estimated that a 70 kg adult would consume around 200 to 300 mg of caffeine per day in most Western countries. This is equivalent to two to four cups of brewed coffee or four to six cups of tea per day.

Every day, millions consume caffeine to increase wakefulness, alleviate fatigue, and improve concentration and focus. Amid myths and controversy about whether caffeine is good or bad for us, evidence suggests that moderate coffee consumption can bring both benefits and risks.

However, a high consumption of caffeine may not be healthful. In addition, the recent trend of adding caffeine to drinks and snacks that do not naturally contain it has raised new concerns.

Caffeine is a stimulant, which means it increases activity of the brain and nervous system. It also increases the circulation of chemicals such as cortisol and adrenaline in the body. Caffeine is naturally found in the leaves and fruits of some plants. It is in coffee, black and green tea, cocoa, cola soft drinks and energy drinks. It may also be in chocolate bars, energy bars and some non-prescription medications, such as cough syrup and slimming tablets. Guarana (a popular additive in energy drinks) is also a natural source of caffeine.

In small doses, caffeine can make you feel refreshed and focused. In large doses, caffeine can make you feel anxious and have difficulty sleeping. Like many other drugs, it's possible to develop a tolerance to caffeine, which means you need bigger and bigger doses to achieve the same effect.

PHARMACOLOGY OF CAFFEINE

Caffeine stimulates the central nervous system first at higher levels, resulting in increased alertness and wakefulness, faster and clearer flow of the thought, increased focus and better general body coordination and later at the spinal cord level at higher doses.

METABOLISM

Caffeine is completely absorbed by the stomach and small intestine within forty-five minutes of ingestion. After ingestion it is distributed throughout all tissues of the body and is eliminated by first order kinetics. In women taking oral contraceptives, caffeine half life increased to 5-10 hours and in pregnant women, the half-life is roughly 9-11 hours. Caffeine can accumulate in individuals with severe liver disease and its half-life can increase to 96 hours. In infants and young children, the half-life may be longer than in adults, its half-life in a new born baby may be as long as thirty hours. Other factors such as smoking can shorten caffeine's half-life.

MECHANISM OF ACTION

Caffeine action is thought to be mediated via several mechanisms, the antagonism of adenosine receptors, the inhibition of phosphodiesterase, the release of calcium from intracellular stores, and antagonism of benzodiazepine receptors.

CAFFEINE AND ADENOSINE RECEPTORS

The ability of caffeine to inhibit adenosine receptors appears to be highly important in its effects on behavior and cognitive function. This ability results from the competitive binding of caffeine and paraxanthine to adenosine receptors and is of importance in contributing to CNS effects, especially those involving the neuromodulatory effects of adenosine. Due to the blocking of adenosine inhibitory effects through its receptors, caffeine indirectly affects the release of norepinephrine, dopamine, acetylcholine, serotonin, glutamate, gamma-aminobutyric acid (GABA), and perhaps neuropeptides.

EFFECT OF CAFFEINE IN THE BODY

Caffeine is well absorbed by the body, and the short-term effects are usually experienced between 5 and 30 minutes after having it. These effects can include increased breathing and heart rate, and increased mental alertness and physical energy. Depending on the individual, these effects can last up to 12 hours.

Some of the signs and symptoms of having too much caffeine include:

- Dehydration
- Frequent urination
- A rise in body temperature

- Rapid heartbeat (palpitations)
- Trembling hands
- Restlessness and excitability
- Anxiety and irritability
- Dizziness and headaches
- Sleeplessness
- first feeling energetic but then having an even greater feeling of tiredness.

DEHYDRATION: As a chemical, caffeine increases production of urine, which means caffeine is a diuretic. But most research suggests that the fluid in caffeinated drinks balances the diuretic effect of typical caffeine levels. High doses of caffeine taken all at once may increase the amount of urine the body makes.

FREQUENT URINATION: it causes the body to send signals to your pituitary gland that inhibits the production of the ADH hormone, which in turn causes the kidneys to not reabsorb water. This will increase the excretion of water via urine.

RISE IN BODY TEMPERATURE: Increased alertness by caffeine is associated with a higher core body temperature (CBT). A lower CBT and a narrow distal-to-proximal skin temperature gradient (DPG) have been reported to be associated with improved sleep, yet whether caffeine influences the DPG is unknown.

RAPID HEART BEAT: Drinking caffeine promotes the release of noradrenaline and norepinephrine which can increase heart rate and blood pressure in some individuals. For most people this is well tolerated, but for others it may lead to palpitations or extra beats from the heart.

TREMBLING HANDS: Both stress and caffeine can cause a physiologic tremor. In other words, these stimulants make your heartbeat and blood flow more pronounced, causing a subtle tremor.

RESTLESSNESS AND EXCITABILITY: Caffeine activates noradrenaline neurons and seems to affect the local release of dopamine. Many of the alerting effects of caffeine may be related to the action of the methylxanthine on serotonin neurons. The methylxanthine induces dose-response increases in locomotor activity in animals. Caffeine affects the brain by blocking adenosine receptors. Adenosine is a sleep-promoting chemical that is produced in the brain during our waking hours.

DIZZINESS AND HEADACHE: Because caffeine narrows the blood vessels that surround the brain, when consumption is stopped, the blood vessels enlarge. This causes an increase in blood flow around the brain and pressures surrounding nerves. This can then trigger what is known as a caffeine withdrawal headache.

SLEEPLESSNESS: Caffeine is a type of drug that promotes alertness. These drugs are called “stimulants.” Caffeine acts as an “adenosine receptor antagonist.” Adenosine is a substance in the body that promotes sleepiness. Caffeine blocks the adenosine receptor to keep you from feeling sleepy.

BLINKING

Blinking has been described to occur voluntarily, reflexively or spontaneously. Reflex blinks are evoked by external stimuli (including auditory, flashes of light, and mechanical stimulation of the ocular surface or surrounding structures), or by the ocular dryness that accompanies the destabilization and rupture of the tear film.

Blinking is responsible for tear distribution on the ocular surface and contributes to maintain corneal and conjunctive integrity. After blinking, it takes the tear a second to distribute evenly and acquire its characteristic aspect, where mucins are in contact with the corneal epithelial surface, the lipid phase in contact with the air and the aqueous phase between these two layers.

The tear film protects the surface of the eye from environmental factors and minimizes damages caused by corneal exposure. Each animal species has its own blink pattern, which is believed to be related to the time the tear film remains intact. In the case of humans, the average eyeblink rate is 3 to 25 times per minute.

Involuntary blinking takes place spontaneously and voluntary blinking depends on the individual's control. Furthermore, voluntary blinking is divided into spontaneous, which takes place at constant intervals, and reflex, resultant from an external corneal stimulus. Involuntary blinking lasts from 290 to 750 milliseconds. It is influenced by several conditions, among them the environmental lighting, temperature, air draught speed, ocular pathologies, and attention levels.

Blinking is said to be complete when the eyelid closes completely and conceals the ocular bulb; on the other hand, blinking is said to be incomplete when eyelid closure is partial. Blink rate may be affected by some ocular surface changes, ocular diseases, sexual activities, attention levels, and other conditions such as lighting, temperature, airflow and work-related factors.

Absence of blinking or a blink rate decrease may lead to the rupture of the tear film and cause discomfort, eye strain, burning sensation, excessive lacrimation, willingness to keep the eyes closed, pain, keratitis, visual alterations and decrease in vision capability.

ORIGIN AND PHYSIOLOGY OF BLINKING

It is often assumed that blinking is a reflex initiated by cornea dryness but for spontaneous blinking this is not so. Blinking occurs with no external stimulus rather, it is mediated by signal from the brain. Spontaneous eye blinking is determined by the activity of a “blinking center” in the globus pallidus of the caudate nucleus. The influences of the superior colliculus in the neuronal circuits of the blink reflex also have been demonstrated by a study on monkeys. There is a strong association between blinking and the action of the extraocular muscles. Eye movement is generally accompanied by a blink and it is thought that this aids the eye in changing their fixation point. Spontaneous blinking has revealed the reciprocal innervations between the levator palpebrae superioris and orbicularis oculi muscles. Immediately before a blink the activity of the levator palpebrae muscles ceases, whereas the orbicularis Ocular motor neurons produce a short high frequency burst of activity. At the end of a blink the orbicularis oculi activity turns off and the levator palpebrae returns to its previous tonic activity.

TYPES OF BLINKING

1. Spontaneous blinking: spontaneous blink is a rapid, automatic, and unconscious closing and opening movement of the eyelids. It is essential for tear film spreading over the ocular surface, including lipid secretion into the tear film and tear drainage. Moreover, a spontaneous blink has implications for the optical quality of the eye. Spontaneous blinking is influenced by age and mental activity, and has complex interactions with the ocular surface. Although the stimulation of the ocular surface increases the spontaneous blink rate, a low blink rate is also a risk factor for the development of DED by increasing tear film evaporation. Although the rate of spontaneous (i.e., endogenous) eye blinks has been repeatedly found to be related to cognitive processes, it

has been recently reported to be modified by level of attention while watching a television screen (Andreu-Sánchez et al., 2017). In particular, it has been shown that the endogenous eye blink is a response controlled by the cortex (Orchard and Stern, 1991). Its characteristics, like rate and temporal distribution, allow it to be distinguished from voluntary or reflexive eye-lid movements, and it seems to reflect cognitive states.

2. Reflex blinking: Reflex blinking, also named corneal reflex, is a rapid short-lived closing movement produced by various external stimuli, including bright lights, approaching objects, loud noises and corneal, conjunctival or eyelash rubbing. It is a reliable measure of afferent trigeminal VI and efferent facial nerve VII fibres.

3. Voluntary blinking: This is a type of blinking that is performed by the subject consciously.

IMPORTANCE OF BLINKING

Without blinking, one will have dry, uncomfortable or painful eyes. You also wouldn't be able to see as clearly, and you will have a much higher risk of eye infections. Blinking keeps your eyes healthy in many ways.

- Protects your eyes from irritants and dangerous objects.
- Removes dead cells, dried tears and other debris from your eyes.
- Spreads lacrimal secretions (tears) across your eyeballs, keeping your eyes lubricated and comfortable.
- Sends oxygen and nutrients to your eyes.

BLINK RATE

Several studies have investigated the blink rate and the interval between blinks. It has been reported that the normal spontaneous blink rate is between 12 and 15/min. Other studies showed that the interval between blinks ranges from 2.8 to 4 and from 2 to 10 s. A mean blink rate of up to 22 blinks/min has been reported under relaxed conditions. The variability in the blinking measurements of previous studies may be due to differences in experimental conditions.

The blink rate may be affected by many factors, including Parkinson's disease and corneal sensitivity disorders, that reduce the number of blinks and cause excessive ocular surface exposure. Additionally, patients with progressive supranuclear palsy have a reduced blink rate, perhaps attributable to a decrease in corneal sensitivity caused by loss of corneal nerves. Other factors such as changes in the gaze, lighting, ambient temperature, and humidity may also affect the blink pattern.

1.2 STATEMENT OF THE PROBLEM

Caffeine is a known stimulant that affects nervous system and probably the most widely consumed psychoactive substance claimed to have conflicting effects on blink rate and blinking plays a critical role in the health of the eye. This research will seek to assess the influence of caffeinated coffee consumption with blink rate.

1.3 AIMS AND OBJECTIVES

Aim of study

To determine the effect of caffeine(coffee) on blink rate of adults.

OBJECTIVES OF STUDY

The objectives of this study was

1. To determine if caffeine intake (coffee) will increase blink rate.
2. To determine if caffeine intake (coffee) will decrease blink rate.
3. To check for the statistical significant in any differences observed between caffeine intake and blink rate.

1.4 HYPOTHESIS

Alternate Hypothesis (Ha)

1. There is a significant difference in blink rate between before intake and 15 mins after intake of caffeine.
2. There is a significant difference in blink rate between before intake and 30 mins after intake of caffeine.
3. There is a significant difference in blink rate between before intake and 45 mins after intake of caffeine.
4. There is a significant difference in blink rate between before intake and 60 mins after intake of caffeine.

1.5 SIGNIFICANCE OF STUDY

1. This will enable the eye care providers to gain better knowledge in the management of ocular disease e.g dry eye
2. This will also serve as a guide in educating patients especially older patients on the intake of caffeine and its effect
3. To contribute to the available literature on caffeine and blink rate.

1.6 DEFINITION OF TERMS

1. CAFFEINE: Caffeine is a stimulant, which means it increases activity in the brain and nervous system. It also increases the circulation of chemicals such as cortisol and adrenaline in the body. Caffeine is naturally found in the leaves and fruits of some plants.

2. BLINKING: Blinking is a complex neuromuscular reaction. The downward movement of the upper eyelid results from neural inhibition of the levator palpebrae muscle, with simultaneous activation and contraction of the orbicularis oculi muscle.

3. BLINK RATE: A patient's blink rate is an important parameter when assessing their ocular health, especially during a dry eye evaluation. The blink rate may be affected by many factors, including Parkinson's disease and corneal sensitivity disorders, that reduce the number of blinks and cause excessive ocular surface exposure. Additionally, patients with progressive supranuclear palsy have a reduced blink rate, perhaps attributable to a decrease in corneal sensitivity caused by loss of corneal nerves.

CHAPTER TWO

2.0 LITERATURE REVIEW

A study carried out by Alozie et al.,(2022) on the effect of caffeine on blink rates of adult during conversation. A total of 100 subjects aged 18-50 years participated in the study, blink rate was taken for each subject at 30, 45 and 60, minutes after coffee consumption. This study also compared the effect of caffeine based on gender and found no significant difference between blink rate in both sexes. However, it was concluded that caffeine significantly decreased blink rate during conversation and also there was an effect in respect to age.

A study on the effects of caffeine intake on visual performance of the eye among normal healthy adults was carried out by Cooper et al.,(2018). In this study, a randomized placebo-controlled crossover study included 49 normal healthy adults aged 18 years and above who received either 200mg of caffeine or placebo capsules. Choroidal thickness, tear break-up time, accommodative power, pupil size and reading performance were assessed at baseline, 1 hour and 2 hours. Consumption of caffeine showed an increased effect on reading rate,there was no significant difference seen between the caffeine and placebo group in choroidal thickness, pupil size and accommodative power. It was concluded that caffeine consumption has some effect on visual performance of the eye by increasing reading rate and tear film quality.

Ovenseri et al.,(2014) carried out a study on the effect of caffeine on tear secretion. This study sought to investigate the effect of orally ingested caffeine on tear secretion.The effect of caffeine intake on tear secretion was studied in 41 healthy volunteers aged 20 to 26 years, Participants were randomly assigned into two groups, A and B, to receive two different treatments in two sessions. Schirmer 1 scores were measured repeatedly at 45, 90, 135, and 180 minutes after

treatment and the baseline Schirmer 1 scores were compared with post treatment scores. From this study, orally ingested caffeine appears to stimulate tear secretion in healthy non-dry eye subjects.

Mbamba et al.,(2023) carried out a study on the distribution of blinkrate among Malawian young adults.The aim of this study was to establish the cut-off blink rate value among Malawian young adults including the effects of sex and age on the parameter.The study recruited 98 participants, 50% male and 50% female and age ranged from 17–45 years. The blink rate was measured manually by observing the number of blinks per minute. This study confirmed that blink rate varies according to geographical location as a factor of different weather conditions.

A study on blink patterns in normal and dry eye subjects was carried out by White et al.,(2010). This study was conducted to better characterize the presentation of blink patterns in normal and dry eye subjects. The study evaluated not blink rate alone, but blink patterns, meaning the occurrence of blink types,(extended, full, partial), varying interblink intervals, and the completeness of blinks over time. A total of 20 subjects participated (n= 10 diagnosed with dry eye, n= 10 normal). Blink patterns were collected over a ten minute period while the subject performed a controlled visual task (television watching) and were compared between populations. It was concluded that these two patient populations are clearly differentiated in blink pattern and have confirmed increased frequency of blinks in dry eye subjects.

A study carried out by Ali.,(2017) on the Changes in blink rate and ocular symptoms during different reading tasks. This study measured differences in the blink rate and symptoms of ocular discomfort in healthy participants during reading from a tablet and a paper book.Forty healthy, normal males subjects were recruited for this study. Subjects were video recorded during reading

a text presented on an electronic device (9.7 inch tablet) and a hard copy format, for 15 min. The study confirmed that both the blink rate and ocular discomfort symptoms were strongly affected during performance of close visual tasks.

Savia et al., (2005) carried out a study on the effect of caffeine on tear formation. The effect of caffeine on tear formation of thirty young healthy subjects, was studied using Schirmer test 1. The tear formation was evaluated before and after intake of 150ml cup of coffee (caffeine concentration of 1.65 g/l derived by dissolving a teaspoon of pure coffee in 150ml of water). It was concluded that it may be necessary to advise patients with symptoms of dry eye to avoid caffeinated substances so as not to aggravate their condition.

Raymond et al., (2000) carried out a study on Baseline blink rates and the effect of visual task difficulty and position of gaze. The purpose of this study was to compare the baseline blink rates (BBR) measured under different (baseline) conditions, and to compare the blink rates measured when performing two visual tasks of different levels of difficulty at two positions of gaze. In the first single masked experiment, BBR were measured under three different conditions – (i) conversation with the subjects (ii) taking the visual acuity and (iii) keeping the subjects waiting in an empty examination room. In the second single masked experiment, the subjects were required to perform an easy task (reading normal English words) and a difficult task (reading mirror-image English words) at primary gaze and down gaze. It was concluded that BBR measured under different (baseline) conditions produced different results so it is important for investigators to describe the baseline condition very clearly in studies where BBR are measured.

A study carried out by Ashura et al., (2020) on the relationship between caffeinated coffee intake and ocular parameters among young adults. This research was conducted to assess the influence

of caffeinated coffee consumption with intraocular pressure [IOP] and amplitude of accommodation [AA]. Fifty subjects were recruited between the ages of 18 and 29 years. A 240ml of Nescafe Original was given to the subjects to drink. The IOP and AA value of subjects were taken at baseline, 30 and 60 minutes after coffee consumption. It was then observed that all the changes were still within the normal range and result obtained indicated that there was no influence on IOP and AA for both male and female after 60 minutes consumption.

A study carried out by Michael.,(2019) on the Effect of distance vision and refractive error on the spontaneous eye blink activity in human subjects in primary eye gaze. The purpose of this study was to evaluate whether visual target character and visibility affects spontaneous eye blink rate (SEBR) in primary eye gaze and silence. Video recordings were made of young healthy adults who were either emmetropic (n = 32) or who wore spectacles for refractive error (range -4.75 D and +4.50 D (n = 31). Emmetropes had 5 min recordings made whilst seated and looking towards a distant whiteboard. The studies indicate that some form of visual target could be useful to promote constancy of spontaneous eye blink activity over time, but that a distance visual target (when provided) does not need to be seen clearly.

Nicholas et al.,(2017) carried out a study on Caffeine increases the velocity of rapid eye movements in unfatigued humans. Within a placebo-controlled crossover design, 13 healthy adults ingested caffeine (5 mg·kg⁻¹ body mass) and were tested over 3 h. Eye movements, including saccades, smooth pursuit and optokinetic nystagmus, were measured using infrared oculography. These results show that oculomotor control is modulated by a moderate dose of caffeine in unfatigued humans. These effects are detectable in the kinematics of rapid eye movements, whereas pursuit eye movements and visual perception are unaffected. Oculomotor

functions may be sensitive to changes in central catecholamines mediated via caffeine's action as an adenosine antagonist, even when participants are not fatigued.

Aslan et al.,(2019) carried out a study on the acute effects of single cup of coffee on ocular biometric parameters in healthy subjects. The aim of this research was to evaluate ocular biometric changes in healthy subjects after caffeine consumption from a cup of coffee. A total of 36 subjects were included in this prospective observational study. Axial length (AL) and anterior segment parameters including aqueous depth (AD), anterior chamber depth (ACD), lens thickness (LT), and central corneal thickness (CCT) were measured with optic biometry, Lenstar LS 900 (Haag-Streit, Inc., Koeniz, Switzerland) before and 1 and 4 h after ingesting a cup of coffee (60 mg caffeine/100 mL). It was concluded that Caffeine causes a significant increase in AD and ACD and a significant decrease in LT following oral intake, for at least 4 h.

A study carried out by Avisar et al.,(2002) on the Effect of coffee consumption on intraocular pressure. The objective of this research was to estimate the effect of drinking coffee on intraocular pressure (IOP). In this crossover study, the effect of the consumption of regular (180 mg caffeine in 200 mL beverage) and decaffeinated coffee (3.6 mg caffeine in 200 mL beverage) was compared in patients with normotensive glaucoma or ocular hypertension. IOP was monitored in both groups at 30, 60, and 90 minutes after coffee ingestion. It was concluded that Intake of caffeinated beverage (≥ 180 mg caffeine) may not be recommended for patients with normotensive glaucoma or ocular hypertension.

CHAPTER THREE

3.0 METHODOLOGY

3.1 RESEARCH DESIGN

This study was a Prospective Observational research study

3.2 SAMPLING TECHNIQUE

Convenient sampling technique was used in this study

3.3 STUDY MATERIAL

- 1.8 gram of Nescafe coffee powder
- Distilled water (room temperature)
- 100 millilitre glass cup
- Stirrer
- Penlight

3.4 STUDY POPULATION

The population for this study were healthy adults within the age of 18-40 years.

3.5 SAMPLE SIZE

Sample size was determined by adopting the standard formula which is the fisher formula

$$N = Z^2 pq / d^2$$

Where,

N= The desired population sized/sample size

Z= The standard statistics for a level of confidence interval 95% (1.96)

P= The proportion of the target population estimated to have relevant characteristics being measured based on previous studies= 5.02% = 0.05(Murari et al. 2018).

q= 1-p= 1-0.05 = 0.95

d = 0.05/ level of statistical significance

$N = 1.96^2 \times 0.05 \times 0.95 / 0.05^2$

$N = 0.182476 / 0.0025$

N= 72.99

Allowing for 10% attrition factor

$72.99 \times 0.1 = 7.29$

Total sample size = 72.99 + 7.29= 80.28

85 participant will be used for this study for credibility

3.6 STUDY DURATION

This study was carried out within the period of 3 months.

3.7 STUDY LOCATION

This study was carried out in the University of Benin Optometry Teaching Clinic

3.8 INCLUSION CRITERIA

- Participants within the ages of 18-45 years
- Participants without any lid deformities
- Participants without any ocular pathology
- All healthy participants that are willing to take part in the study
- Participants without any ocular symptoms like Asthenopic symptoms.
- Participants who do not take any systemic drug like halucinogenic drug

3.9 EXCLUSION CRITERIA

- Participants who are intolerance to coffee
- Participants with systemic illness like hypertension and diabetes.
- Life style related factors of the participants
- Monocular individual
- Participants on topical eye medication.

3.10 ETHICAL CONSIDERATION

Ethical approval was obtained from the Ethical Committee of the Department of Optometry, University of Benin in accordance with the tenets of the declaration of Helsinki. Informed consent will be obtained from the study participants after thorough explanation of the purpose of the study to them.

3.11 DESCRIPTION OF PROCEDURES

Screening procedures

1. Case history
2. Visual acuity test
3. External preliminary test
4. Internal examination
5. Measurement of Blink rate

CASE HISTORY: The subjects were made to seat comfortably and case histories taken. This included their chief complaint, oculo- visual history, general medical history, family oculo-visual history, family medical history, last eye examination, and allergy .

VISUAL ACUITY: Visual acuity was measured on the subjects using Snellen distance chart @6m and snellen reduce chart @40cm respectively to determine how well various subjects can see properly and resolve fine details. The subject was well positioned in an adjusted position and the subject was told to read the chart from a distance of 6m and 40cm in a well illuminated environment. The subjects were encouraged to read from the largest letter up to the least letter they could read comfortably on the chart and the visual acuity was then recorded for various subjects.

EXTERNAL PRELIMINARY TESTS: This was carried out on the subjects with the use of a penlight to rule out any form of abnormalities in the external part of the eyes. Patient with any ocular abnormalities were not qualified for the experiment. The subjects were placed in a well

comfortable seated position and the penlight was placed in front of the patient to access the adnexia (lashes, lids and the eye brows), the conjunctiva (palpebral, bulbar and fornix), cornea for any ocular abnormalities. The penlight was also used to determine the estimation of the anterior chamber angle (shadow test) of the various subjects.

INTERNAL EXAMINATION: This is an objective method of examining the interior of the eye. The instrument used is known as ophthalmoscope, to examine the posterior segment of the eye and the procedure was carried out under dim illumination . The ophthalmoscope was first held at 10cm from the subjects eye using the spot beam with a +10 dioptre lens, the optical clarity of the media was examined and the red reflex of the fundus was observed. The posterior segment was accessed by moving the ophthalmoscope closer to the patient eyes until the hand holding the ophthalmoscope touch the patient face while reducing the plus power of the ophthalmoscope until the features of the ocular fundus came into focus. The optic nerve head was located to examine the disc margin, rim tissue, cup size and depth. The cup to disc ratio was also examined, vasculature was evaluated to determine the thickness of arteries and the vein, arteriovenous ratio, the course of the vessels and the arteriovenous crossings. The macula and fovea reflex was also examined to exclude any abnormalities.

Thereafter, participants was selected with informed written consent to undergo the examination, as well as for participating in the study were taken.

MEASUREMENT OF BLINK RATE

- ❖ The participants were allowed to rest for about 7 minutes and then interact for 1 minutes during which the participants talked with the researcher on general issues to make for relaxation.
- ❖ The number of blinks per minute were noted and recorded.
- ❖ After which the participants were given 1.8 grams of Nescafe coffee powder, mixed with 100 millilitres of water, under room temperature.
- ❖ Each participant drank the coffee comfortably and the exact time of coffee intake were noted.
- ❖ Number of blinks at 15 minutes were taken after each participants consume the Nescafe coffee.
- ❖ Blink rate was taken for each participant at 30, 45 and 60, minutes after coffee consumption.
- ❖ The number of blinks for each minutes were noted and recorded.

3.12 DATA ANALYSIS

The data obtained were subjected to statistical analysis using the paired T-test in the statistical package for social sciences(SPSS) version 22.0.

3.13 LIMITATION OF STUDY

1. Lack of cooperation of participant.
2. In accurate measurements

CHAPTER FOUR

4.0 RESULTS

This chapter dealt with the presentation of result. The results of the analysis were presented in the order of the hypothesis that guide the study.

Table 4.1: Mean Age of Participants

Mean	N	Standard Deviation
27.35	85	7.52

The participants had a mean age of 27.35 ± 7.52 years.

Gender
Male
Female

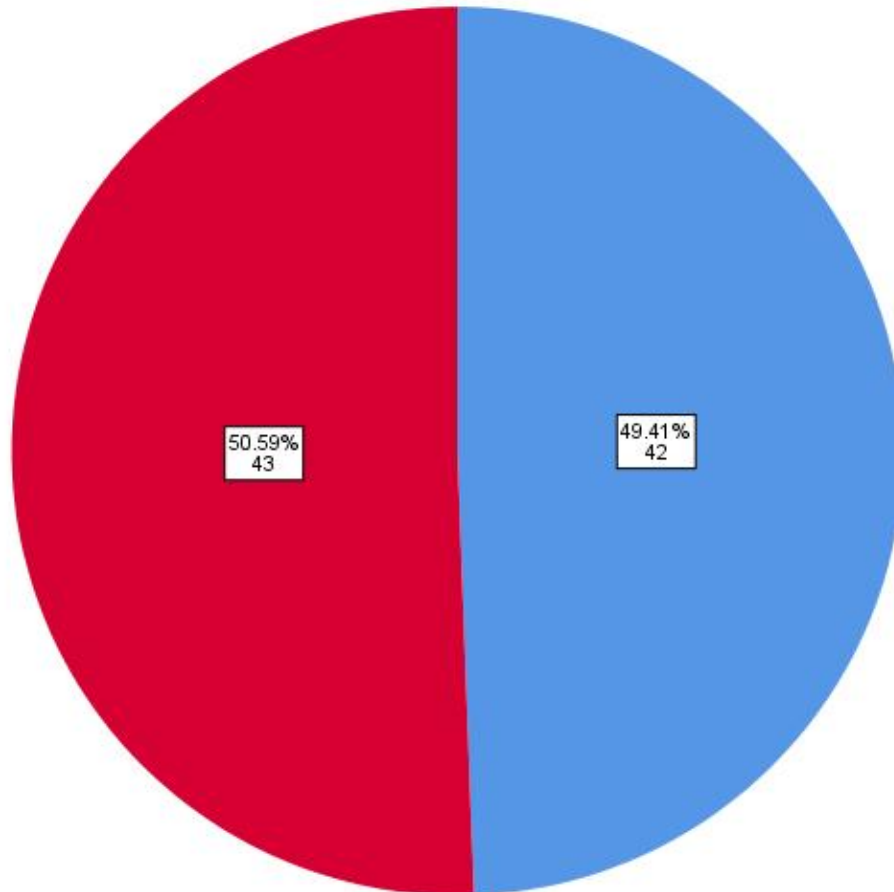


Figure 4.1: Gender Distribution among Participants

The participants consisted of almost equal distribution of gender, with a slightly higher proportion of females (n = 43; 50.59%).

Table 4.2: Means and Standard Deviations of Blink Rate before and after Consumption of Caffeine

	Mean	Standard Deviation
Before	17.38	2.10
After 15 minutes	15.04	2.23
After 30 minutes	13.91	2.55
After 45 minutes	12.42	2.66
After 60 minutes	16.69	2.20

There was a reduction in the blink rates of participants after consuming caffeine. Peak reduction was observed 45 minutes after the consumption of caffeine. After 60 minutes, blink rate increased but not up to the baseline.

Table 4.3: Paired T-test Comparing Blink Rate Before and After Consumption of Caffeine

		Mean	Standard Deviation	P-Value
Pair 1	Before – After 15 minutes	2.34	1.14	0.000
Pair 2	Before – After 30 minutes	3.47	2.15	0.000
Pair 3	Before – After 45 minutes	4.95	1.96	0.000
Pair 4	Before – After 60 minutes	0.68	1.67	0.000

There was a statistically significant reduction in the blink rate of participants after the consumption of caffeine ($p < 0.05$).

CHAPTER FIVE

5.0 DISCUSSION

The purpose of this study was to determine the effect of caffeine on blink rate of adults ranging from 18-45 years of age with the use of coffee. The various blink rates at different intervals was measured carefully at 15 mins, 30 mins, 45mins and 60 mins after caffeine consumption. It is important to know that caffeine is a known stimulant that affects nervous system and probably the most widely consumed psychoactive substance that is claimed to have conflicting effects on blink rate and blinking plays a critical role in the health of the eye.

The test results showed that the blink rates after caffeine consumption, reduces with time. From table 4.2 respectively, the mean baseline was 17.38 and the mean blink rates after caffeine consumption was 15.04, 13.91, 12.42, and 16.69 for 15, 30, 45 and 65 minutes respectively taken. Also, the standard deviation baseline was 2.10 and the SD blink rates post consumption of caffeine was 2.23, 2.55, 2.66 and 2.20 for the various time intervals(15mins, 30mins, 45mins and 60mins).

The results were verified using paired T-test. Statistical method of analysis and all hypotheses were tested at 0.05 level of significance. The changes however were observed to be reversible starting from 60mins after caffeine consumption while the highest value effect was observed 15 minutes post consumption of caffeine. This is because caffeine's effect on the body starts at about 15 minutes after caffeine consumption.

15 minutes post consumption of caffeine decreased mean baseline of 17.38 to a mean of 15.00 blink/min by 40%. 30 minutes post consumption of caffeine decreased by 35% from a baseline of 17.38 to mean of 13.91. 45 minutes post consumption of caffeine decreased by 20.25% from

mean baseline of 17.38 to mean of 12.42. 60 minutes post consumption of caffeine decreased by 10.25% from mean baseline of 17.38 to mean of 16.69.

These findings were in accordance with the results obtained by Alozie et al. on the effect of caffeine on blink rate during conversation where they got a total mean of 16.17 blinks per minute on 100 subjects used although the total mean blink rate was slightly different from this research study maybe due to the age range used. The post caffeine consumption blink measurement was taken at 15, 30, 45, and 60 mins respectively. This study also compared the effect of caffeine based on gender and found no significant difference between blink rate in both sexes. The results show a significant reduction on blink rates of the subjects.

These findings concur with the results obtained by Ajayi., et al. on the effect of caffeine on blink rate where he got a total mean blink rate of 16.80 blinks/min on 120 subjects used. The post caffeine intake blink measurement was taken at 30, 60 and 90 minutes after ingestion of caffeine by two groups of subjects namely the experiment and control groups. The results showed a significant decrease on blink rates of the subjects.

The findings of the study also coincide with that obtained by Avasor., et al. on the effect of consumption of regular caffeinated coffee between young adults of 18 to 35 years and older subjects of 45 to 60 years. His study concluded that older subjects tend to blink less than younger subjects.

The total mean blink rate for pre consumption of caffeine was 17.38 blinks/min. This finding differs from the study by Bentivoglio., et al. on the analysis of blink rate patterns in normal subjects where he computed the mean blink rate during conversation as 26 blinks/min. This may be because of the wide age variation which he used, the study was conducted using 140 subjects

(70 male and 70 female) ranging from 5 to 87 years. But Valeri, stated that mean blink rate of young adults is 24.93 blinks/min and 25.13 blinks/min respectively hence supporting the researcher's findings. According to this research work, there is no difference in blink rates of young males and females. This supports the finding of Robert, Valeri, and Bentivoglio.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

From this Study, It was concluded that caffeine intake reduces blink rate in adults.

It also showed that;

There is a difference in blink rate between before intake and 15 mins after intake of caffeine.

- There is a difference in blink rate between before intake and 30mins after intake of caffeine.
- There is a difference in blink rate between before intake and 45mins after intake of caffeine.
- There is a difference in blink rate between before intake and 60mins after intake of caffeine.
- In general , there is a difference of the effect of caffeine in the mean blink rates of old and young adults.($P < 0.05$)

6.2 RECOMMENDATION

- Excessive intake of caffeine should be avoided since caffeine intake reduces blink rates which could cause improper functioning of the eye e.g Dry eyes.
- More enlightenment should be carried out in the therapeutic use of caffeine for people who are been managed for certain disease conditions

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APPENDIX

Paired Samples Correlations

			N	Correlation	Sig.
Pair 1	Before & After15		85	0.864	0.000
Pair 2	Before & After30		85	0.588	0.000
Pair 3	Before & After45		85	0.686	0.000
Pair 4	Before & After60		85	0.699	0.000

Paired Samples Test

		Paired Differences							
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Before - After15	2.3418	1.13968	0.12362	2.09535	2.58700	18.939	84	0.000

Pair	Before	-	3.470	2.14691	0.23287	3.00751	3.93367	14.90	84	0.000
2	After30		59					4		
Pair	Before	-	4.952	1.95732	0.21230	4.53076	5.37512	23.33	84	0.000
3	After45		94					0		
Pair	Before	-	0.682	1.67056	0.18120	0.32202	1.04268	3.766	84	0.000
4	After60		35							

S/ N	Gender	Age	Before Intake	15mins	30mins	45mins	60mins
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1	F	20	17	15	13	14	17
2	F	23	18	14	12	10	15
3	M	26	19	14	12	16	17
4	F	19	17	15	16	13	17
5	F	18	19	17	15	14	16
6	M	22	15	13	11	10	18
7	M	20	20	18	16	17	20
8	M	19	18	14	15	12	19
9	F	25	21	16	18	14	20
10	M	23	14	11	12	9	13
11	F	21	19	16	14	15	16
12	F	19	18	17	15	13	15
13	M	24	19	15	14	13	17
14	F	23	18	16	15	13	16
15	M	21	17	16	13	12	18
16	M	18	20	19	18	15	17
17	M	22	15	13	11	10	18
18	F	27	19	15	14	15	19
19	M	23	14	13	12	11	14
20	F	25	21	19	20	16	19
21	F	21	18	16	14	13	20
22	F	18	20	15	17	14	19

23	M	40	15	11	8	6	17
24	F	38	17	15	13	11	16
25	M	22	19	16	13	12	20
26	M	25	16	15	13	11	15
27	F	35	15	11	12	10	14
28	F	32	14	13	14	11	11
29	M	30	17	14	11	10	16
30	F	29	15	13	10	14	15
31	M	32	18	15	13	12	17
32	M	31	14	12	16	13	18
33	M	28	18	16	12	16	16
34	F	25	21	18	15	13	19
35	M	21	20	18	16	15	18
36	F	19	19	15	16	13	19
37	M	44	14	12	10	8	16
38	M	27	19	18	15	13	20
39	F	20	18	17	16	12	18
40	F	18	17	15	13	16	17
41	M	43	17	14	10	9	15
42	F	32	15	12	16	10	12
43	M	29	19	16	14	12	19
44	F	39	18	16	14	10	17

45	F	24	18	16	14	17	15
46	M	26	17	16	13	16	17
47	M	23	16	13	12	11	14
48	M	19	21	19	17	15	20
49	M	45	15	14	11	8	13
50	F	33	14	12	15	12	13
51	M	36	19	15	10	12	15
52	F	18	21	19	17	16	20
53	F	22	17	16	15	14	14
54	M	27	18	17	15	13	19
55	F	24	19	16	13	15	18
56	M	41	14	11	10	8	15
57	M	30	15	12	14	8	16
58	F	34	15	13	15	12	14
59	F	29	16	16	13	14	17
60	F	38	17	15	12	10	16
61	M	43	16	13	10	7	18
62	M	19	21	19	17	15	20
63	F	21	18	16	14	13	17
64	M	20	19	17	16	15	19
65	F	28	17	16	18	14	16
66	F	22	20	18	16	18	17

67	F	26	17	16	15	12	16
68	M	23	16	13	10	12	15
69	F	19	20	18	17	14	19
70	F	22	17	16	17	14	15
71	M	29	19	17	15	13	19
72	M	42	14	10	12	6	15
73	M	38	17	15	13	10	16
74	F	24	21	18	16	14	20
75	M	41	15	16	14	12	17
76	F	32	14	10	10	8	11
77	F	27	19	17	19	15	18
78	M	29	18	16	14	13	17
79	F	42	13	11	9	7	13
80	F	36	16	13	15	12	15
81	M	21	17	15	16	14	17
82	F	25	19	16	18	14	18
83	M	28	16	13	12	10	19
84	F	27	17	16	17	16	17
85	M	36	18	14	9	11	14