Evaluation of oxidative biomarkers in relation with the self-reported symptoms among over usage of smartphone users on the basis of Gender

By

Pavithra.S
(20pbc016)

Supervisor
Dr . K.V Shalini

A thesis Submitted to
Avinashilingam Institute for Home Science and Higher Education for Women,
Coimbatore – 641043

In Partial Fulfilment of the Requirement for the Degree of
Masters of Science in Biochemistry
May 2022

Certificate

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Signature of the Head of the Department

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Introduction

1 INTRODUCTION

Mobile phones are effective verbal exchange devices , first verified by way of Motorola in 1973 and made commercially available from 1984(Meet Marty Cooper 2016).

Mobile phones are considered to be the most popular portable electronic devices now a days. Recent estimates showed that at least 77% of the world's population has their own mobile phone (Schabrun,*et.al.*,2014) The main reason mobile phone use is emerging and becoming more and more popular world wide is that it is reliable devices for communication and entertainment (Kim,*et.al.*,2015).Portable gadgets are dependable units for work , communication and entertainment. (FadiAl-Hadidi,*et.al.*,2019).Usage of smartphone has grown to be ubiquitous over the pervious decade.(Carolina kolberg ,*et.al.*,2015).The number of mobile cellular subscriptions is constantly increasing every year. In 2016, there were more than seven billion users worldwide. The percentage of internet usage also increased globally 7-fold from 6.5% to 43% between 2000 and 2015. The percentage of households with internet access also increased from 18% in 2005 to 46% in 2015(De-Sola,*et.al.*,2017).

The wireless technology was invented in the year 1880 by Alexander Graham Bell and Summer Tainted when first time the photo phone was invented. In the recent era, there are dissimilar types of mobile phone devices which are utilized for communicating with each other. The mobile telephone sets are also a part and parcel of everyday life all over the globe. The Wi-Fi devices are connected to the exchange of information and data by using the mobile telephones. The Wi-Fi devices also emit the radio waves. There are so many wireless devices like cell phones, tablet PCs, audio players, digital cameras and the personal computer, all devices being used Wi-Fi(Suhag ,*et.al*.,2016)

There has been tremendous growth in the use of the mobile phones in India. It is reported that the India's telecommunication market is the second largest in the world. The mobile phones are available to the people right from the age of 12 years. The mobile phone technology has brought the world closer. It provided great convenience in communication among people by way of either calling or texting. Now, the mobile phones are coming up with variety of features like internet access, sending e-mails, games, access to social networking sites like face-book, listening to music, playing radio, reading books, dictionary and so on. The mobile phones are also used to overcome the feeling of loneliness. The majority of the users are in the age group of 15 to 25 years (Alpana Vaidya *et.al.*,2016).

Smartphone provides an interactive features for an increasingly wider users around the region and the world. It has become an integral part of everyday student's life. The development of smartphones began in the early 1990's and exploded in 2007 dominated by different operating systems with continuous development (Jollie,*et.al*.,2016). Besides communication, mobile phones have been used for other purposes like of playing games, listening to music, etc. Studies have also shown that use of mobile phone for social networking and e-mail has helped to reduce loneliness and in making friends. Resultantly mobile phones have become part and parcel of life of the user. Further, mobile phones have been used for smoking cessation and management of severe mental disorders (Ritu Nehra, *et.al*.,2015).

However, excessive use of mobile phone is also associated with negative health consequences. In 2012, new Time Mobility Poll reported that 84% people "couldn't go a single day without their mobile devices"(Duerson, *et.al*.,2016) .Around 206 published survey reports suggest that 50% of teens and 27% of parents feel that they are addicted to mobiles(Wallace K et.al.,2016) The recent studies also reported the increase of mobile phone dependence, and this could increase internet addiction (Billieux *et.al.*,2006).

Prolonged smart phone usage causes faulty posture such as forward neck posture, slouched posture, or rounded shoulders. Sustained forward neck posture can cause injury to the structure of the cervical and lumbar spine, as well as ligaments. These structural problems caused by faulty posture can also lead to respiratory dysfunction (Perry *et.al*.,2016) investigated the possibility correlation between dysfunctional breathing and musculoskeletal pain patterns.

The various negative consequence of mobile phone use include exposure to electromagnetic fields, headaches, earache and warmth sensations, perceived concentration difficulties, fatigue, dizziness, facial dermatitis, development of brain tumors, frustration and musculoskeletal symptoms due to intensive texting. Also, electromagnetic radiations have been thought to affect the sleep electroencephalogram and melatonin production. Mobile phone use while driving has been associated with increased incidence of road traffic accidents (Rithu Nehra *et.al*.,2016).In latest years, most of the global populations (especially college and university students) use smartphones, due to its broad range of application. Currently, the dependency to smartphones among students is 24.8%-27.8%, and it is regularly growing each year (Jeong *et.al*.,2015).

Mobile telephone is becoming an quintessential part to students with regard to managing fundamental conditions and preserving social relationships (Robert,*et.al*.,2014).The signs of smartphone addiction are constantly checking the cell phone for no reason, feeling

anxious or restless without the phone, waking with center of night time ,conversation updates, lengthen in expert performance as result of prolonged activities (Chen *et.al*.,2016).On usage of mobile phones for prolong duration lead to major problem such as neck pain, head ace. In pain conditions, there is an increase in neural activity due to neuronal excitability, with more utilization of metabolic substrates and increased production of reactive oxygen species(RS).

An overwhelming production can generate oxidative stress leading to deleterious effects on cellular function(Carolina kolberg,*et.al*.,2015).Oxidative stress occurs as a result of an imbalance between increased production and reduced degradation of oxygen reactive species It may lead to damage to lipids, protein and DNA (Droge,*et.al.*,2002).To counteract reactive oxygen species- induced cell damage, biological system have evolved endogenous mechanism to protect themselves in normal physiological conditions(valko,*et.al*.,2007).The cellular antioxidant mechanisms involve non-enzymatic compounds and enzymes such as superoxide dismutase(SOD),Catalase and glutathione peroxidase(GPx)(Trachottam *et.al*.,2007).

Superoxide dismutase is specific to superoxide- radical detoxification .Superoxide dismutase can rapidly dismutate the superoxide radical, yielding hydrogen peroxide and oxygen (Vaculin,*et.al*.,2010).Hydrogen peroxide is a diffusible reactive oxygen species that contributes to the development of pathological pain states, not only by generating harmful reactive species but also by modulating synaptic plasticity (Takahashi,*et.al*.,2007).The modulatory effect of No may be related to neuronal excitability (Kolberg,*et.al*.,2010).

It is important to note that smart phone addiction has several terms of reference including “nomophobia” , “problematic smartphone use” and “smart phone dependence”.

There is also a lack of consensus around whether putative “smartphone addiction” represents a distinct clinical identity and meets the criteria to be formally considered a behavioral addiction (Panova,*et.al*.,2018). Furthermore, it remains unclear whether this dependence is on the smartphone itself or on the apps available through the device; whether the phone itself like a substance of abuse or more like the needle through which addictive apps are delivered (Kalk,*et.al*.,2021).

Nevertheless, there is evidence of the existence of the behavioral phenotype that resembles addiction. The physical harms highlighted above, as well as emerging associations with psychiatric symptoms such as anxiety and depressed mood indicate a pressing need to further investigate this growing phenomenon (Demirci,*et.al*.,2006).While the negative effects of screen time on may occur. Smartphones are portable ,hand held devices that have much higher potential of interrupting sleep quality or quantity(Carter,*et.al*.,2016).

Problematic smartphone use has been consistently linked poor sleep (Yang *et.al.*,2016) and smartphone overuse has been associated with day time tiredness, longer sleep latency and reduced sleep duration (Zou,*et.al*.,2019).In particular, smartphone use close to sleep initiation has been shown to delay cardiac rhythm and found associated with total sleep time, where longer usage was associated with poor sleep(Lin,*et.al*.,2019).

Mobile phone is the most dominant portal of information and communication technology. A mental impairment resulting from modern technology has come to the attention of sociologists, psychologists, and scholars of education on mobile addiction(Babadi-Akashe *et.al*.,2014) .Mobile phone addiction and withdrawal from mobile network may increase anger, tension, depression, irritability, and restlessness which may alter the physiological behavior and reduce work efficacy(Subramani Parasuraman,*et.al*.,2017).

The static muscular load happens with prolonged neck flexion alongside with lack of support to the hands and the repetitive motion of the fingers, mainly when the usage of one hand alone (Gustafsson,*et.al*.,2011).

Another issue that was taken into consideration is the role which the man or woman takes at same stage in smart phone utilization. It is agreed that the fine position is the sitting with a straight neck and helping the forearms, in addition to balance mobile with each arms and to use both thumbs is followed for usual mobile phone usage and this is not followed for prolong duration (Lamberg,*et.al*.,2019).The prolong duration of mobile phone use causes neck and shoulder pain in severity (Hartrick,*et.al.*,2003).

India has the second greatest smart phone customers globally after beating US recently crossing 220 million customers. Smart phone among younger person especially college students are increased. They use their mobile phone as conversation technology. In current years, mobile phones are getting powerful with the aid of including first rate features. Today smart phone are one simple solution to every need in our basic life (Scheid,*et.al*.,2013)

Many gadgets such as watch ,camera, GPS, calculator ,diary, recorder, music player etc., has been changed by the mobile phone.

Currently , the dependency to smart phone among college students is 24.8-27.8% is increasing year by year. Mobile phones are is turning into vital part of life to students to maintain their social relationships (Roberts,*et.al.*,2014)

Mobile phone dependency might increase anger, depression, irritability, restless which may also alter physiological behavior and reduce work efficiency .Smartphones became broadly accessible in 2011 , because than usage has been increased(Mojtabai,*et.al*.,2016)

The study suggest that female participants were having more awareness than male participants were more dependent on smartphones .Female participants were ready to quit using smartphones, if it affected daily lifestyle compared with male participants (Subramani Parasuraman, *et.al*.,2017)

Therefore, this study aims to understand the above mentioned difference in mobile phone use and this study examined gender-related differences in requirements for mobile phones in context of the transition from feature phone to smart phones.

The following objectives were formulated to meet the goal of the study.

Objectives of the study

- To explore the impact of extensive usage of smartphone users through online questionnaire.
- To evaluate oxidative biomarkers in the blood sample of over usage of smartphone users.
- To determine the level of oxidative marker related to gender among over usage of users.

The study was conducted two phases. In Phase 1 Exploration of impact of extensive usage of mobile phone through online questionnaire was carried out. In Phase II Blood samples are collected and oxidative biomarkers were estimated

Review of literature

2

REVIEW OF LITERATURE

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2.2 SMART PHONE USAGE
2.3 POSTURE OF MOBILE PHONE USAGE
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2.15 THE RISE OF MOBILE ADDICT

2.1 INTRODUCTION

Mobile phones are powerful communication devices, first demonstrated by Motorola in 1973, and made commercially available from 1984. Now those Portable devices became integral part of our lives. Mobile phone is become as the most dominant portal for information and communication technology. A mental impairment resulting has come to the attention of sociologists, psychologists, and scholars of education on mobile addiction. Over time usage of Mobile phone may increase anger, tension, depression, irritability, and restlessness which may alter the physiological behaviour and reduce work efficacy (Subramani Parasuraman ,*et.al*.,2017).

Now a days increase in use of smartphones among children and young people (CYP) which has occurred at the same time as a rise in common mental disorders in the same age

group, including reported depressive symptoms, poor sleep and suicide ideation with grave implications for life-long mental health and the healthcare economy.

There is well fare in UK for the CYP which tells us between the association of mobile phones usage among the children. The study explains the challenge in which the study is on harmfulness due to screen time of mobiles but the result was not accurate due to other reasons such that the person may gone through other electronic devices such as television. Recent years have seen an explosion in research considering the prevalence of problematic smartphone use (PSU), concepts of behavioral addiction: tolerance, withdrawal, preoccupation, neglect of other activities, subjective loss of control and continued use despite evidence of harm. Other behavioral addictions, such as problem gambling, show robust associations with common mental disorders such as depression, where sporadic gambling does not. If a distinctive problematic pattern of smart phone use can be demonstrated to be prevalent, and if this pattern of use is associated with harm, there is value in identifying children and young people with this pattern of use and potentially addressing it clinically (Sei You Sohn,*et.al*.,2019).

Smartphone has used more widely over the past 1 decade. There are emerging reports of problematic behavior patterns in relation to smartphone. Smartphone addiction describe a decreased interest in face-to-face relationship. Measuring duration of use is an inexact proxy for addiction, as some people may experience the features of addiction with a lower duration of use while others may use their phone in an adaptive way for long periods of time (for example, answering work emails during a long commute) but be able to put the phone down without distress and attend to appropriate activities such as communicating with family members or going to bed on time. While the negative effects of screen time make higher potential of interrupting sleep quality or quantity. Smartphone overuse has been associated with daytime tiredness, and reduced sleep duration. In particular, smartphone use close to sleep initiation has been shown to delay circadian rhythm and found associated with total sleep time, where longer- usage was associated with poor sleep. Furthermore, poor sleep outcomes may mediate the relationships between smartphone addiction and behavior (Ståle Pallesen,*et.al*, 2020).

The term ‘addiction’ is defined with a certain activity that results in a disturbance of his/her daily activities and shows a pattern similar to substance dependence. The recent studies also reported the increase of mobile phone dependence, and this could increase internet addiction.

Over usage of mobile phones may cause psychological illnesses such as dry eyes, computer vision syndrome, weakness of thumb and wrist, neck pain (Subramani Parasuraman *et al., 2017*). Frequency of mobile phone use, the purpose of mobile use, the degree of neck flexion while using phone, and the body position are the factors associated with neck and shoulder pain and its severity.

Bianchi and Phillips (2005) studied the relationship of extraversion, neuroticism, self-esteem, gender, and age and mobile phone use in the age group from 18 to 85 years and found that extraversion and self-esteem appeared to be important factors. Young people, in particular, appeared to be susceptible high mobile phone use. They were also greater users of SMS function and other features on mobile phones. However, the neuroticism could not predict high use of mobile phone. It was stated that the technical applications like MP3 players attract more male users while females used mobile phones for mixing with friends and relatives. A study conducted to examine the relationship between psychological attributes to smart phone addiction, face-to-face communication, present absence and social capital involving 414 university students aged below 30, it was found that the level of the loneliness, shyness and present absence was positively related to excessive smart phone use. The greater smart phone use predicted lower level of face to face communication (Casey, 2012). In another study of impact of personality traits on smart phone ownership and use with 312 participants (60% females, 40% males) ranging from age 18 to 77 years, it was revealed that extroverts reported greater importance on the texting function whereas the agreeable individuals placed greater importance on making calls and less importance on texting. Neuroticism was positively associated with the e-mail function. The study also found that the age was negatively associated with texting, browsing the internet and playing music. Higher education was positively related to using smart phone for calling but negatively to gaming function. The extraverted individuals were more likely to own a smartphone. Females placed great importance on texting function (Lane and Manner, 2011). Lu, Watanabe, Liu, Uji, Shono, & Kitamura (2011) conducted the study on internet and mobile phone text messaging dependency in which 92 men and 54 women participated. Ages ranged between 22 to 59 years. The study suggested that psychological dependency on internet and mobile phone text messaging in Japan was not limited to students but also affects adults. The study showed that 34% of men and 25% of women showed mild internet addiction and 6.1% of men and 1.8% of women showed pathological use of internet. The study found no gender difference in internet use and mobile phone text messaging. The depression was associated with both internet dependency and mobile phone text messaging dependency whereas anxiety was associated negatively with text message dependency.

A recent study on mobile phone usage worldwide carried out by the telecommunication department stated an increase in the rate of mobile phone users year by year. It further stated that around 4.93 billion people use cell phones worldwide. It is further estimated that 62.9 percent of the population worldwide already own a mobile phone. Based on the aforesaid statement, it comes as no surprise that 73 percent mobile users were the youth and all of them use smart phones. India ranks second in world in the usage of mobile devices after China. It is estimated that by the year 2019 in India would register a whopping 1.1 billion mobile users. The usage of mobile phones among the youth can be denoted based on two factors; the positive impact and the negative impact. While understanding the positives in the usage of mobiles it can be inferred that these devices enable them to organize and maintain their social network but in considering the same the ill aspect is that this also makes them nomophobic. According to PEW Research Center, 67% of smart phone owners have admitted to checking their phone for calls or messages when their phones have not vibrated or rang. This is one major sign of cell phone dependence and should serve as a warning to cell phone owners. There are some signs and Symptoms of Cell Phone Addiction, Physical Effects of Addiction and Psychological Effects of Cell Phone Addiction (Moieeson Thairiyam, *et.al*.,2018)

2.2 SMART PHONE USAGE

The mobile phone technology has brought the world closer. It provided convenience in communication among people by way of calling or texting. The mobile phones are coming up with variety of features like internet access, sending e-mails, games, access to social networking sites like face-book, listening to music, playing radio, reading books, dictionary and so on. The mobile phones are also used to overcome the feeling of loneliness. The majority of the users are in the age group of 15 to 25 years. The contacts are established instantly with the help of mobile phones which was not possible earlier. However, though the mobile phone provided many advantages, it has also caused some problems also. Some people are using the mobile phones so excessively that it assumes the form of addiction. The use of mobile phones has reduced the face to face communication. It is observed that the people sending text messages while talking to others. The students are using mobile phones for playing games, sending messages, calling even when the class is in progress. The mobile phones are used at places like hospitals, judicial courts, petrol pumps where their use is banned. The mobile phone use during driving is commonly observed which may increase the chances of involving in accidents. The use of mobile phone while driving can distract attention of the driver visually, physically and cognitively. Earlier studies have shown that various personality

traits like neuroticism, extraversion, psychoticism, etc. and mobile use have some relation to each other. The gender may also play some role in high mobile phone use (Dr. Alpana Vaidya. *et al.*,2016).

Mobile phone addiction and withdrawal from mobile network may increase anger, tension, depression, irritability, and restlessness which may alter the physiological behavior and reduce work efficacy. (Subramani Parasuraman *et.al*.,2017).

Problematic smartphone usage (PSU) has been consistently associated with measures of poor mental health, in particular relating to depression, anxiety, stress, poor sleep quality. There are some signs of smartphone addiction are constantly checking the phone for no reason, feeling anxious or restless without the phone, waking up in the middle of night to check the mobile and communication updates, delay in professional performance as a result of prolonged phone activities, and distracted with smartphone applications (Subramani Parasuraman,*et.al*.,2017).

2.3 POSTURE OF MOBILE USAGE

The smartphone users tend to report pain in the neck, shoulder, and thumb, and the severity of the symptoms increases as the total time spent using the smartphone (Sang In Jung,.,2016). Prolonged smart phone usage causes faulty posture such as forward neck posture or rounded shoulders. Sustained forward neck posture can cause injury to the structure of the cervical and lumbar spine, as well as ligaments. These structural problems caused by posture can also lead to respiratory dysfunction.

Perry *et al*.,2004 investigated the possibility correlation between dysfunctional breathing and musculoskeletal pain patterns. Their result showed that 83% of patients with neck pain (caused by faulty posture) experienced a changed breathing pattern. This study indicated that there was a relationship between neck pain and respiration. The adverse effects of prolonged sitting and a sedentary lifestyle on our health are well known, and similarly, we should understand the effect of prolonged smartphone usage on our posture and respiratory function. (Perry,*et al*.,2004)

2.4 PSYCHOLOGICAL STRESS

Neuroscience Institute in Manhasset, New York, considered that there is no solid proof between cell phone radiation and tumour risk but the possibility still may exist. Adolescents are at high risk of being smartphone addicts (Cha and Seo,2018). Excessive use of smartphone makes negative attitude and feeling of anxiety and dependency on may increase the risk of anxiety and depression (Rosen et al., 2013).

Jones (2014) conducted an online survey and found that students seemed to be addicted to their mobile phones. It was concluded that the excessive smartphone use had a negative psychological effect. A range of different personality and emotional factors were investigated in relation to PSU (Problematic smart phone usage). Some traits where associated with greater risk-taking (such as low self control, impulsivity, emotional instability) and traits associated with avoidance of risk taking, were more common amongst problematic smartphone users **(**Sei Yon Sohn, *et.al*.,2019)

Sleep disturbance, Depression, Obsessive Compulsive Disorder Relationship problems, and anxiety. Hyun Young Koo and Hyun Sook Park (2010) in their study among adolescents, in which 548 students were asked to fill out a questionnaire regarding their cell phone use. The results of the questionnaires were that just under 89% believed they were a phone users, while 8.4% believed they were heavy users and only 2.9% percent believed they were addicted to their cell phone. This study found that gender, texting, monthly charges, impulsiveness, recreational reasons and cultural reasons were all influential to cell phone addiction.(Moieeson Thairiyam, *et.al*.,2018).

2.5 MYOPIA

Excessive use of digital smart devices, including smartphones and tablet etc could be a risk factor for myopia. The widespread of myopia is increasing worldwide, with half of the global population expected to have myopia by 2050. Along with myopia and it also causes irreversible blindness may occur in upcoming decades. The myopia epidemic is likely to be driven by exposure to environmental risk factors present in ever more urban and developed societies, with two major risk factors of particular concern: insufficient time spent outdoors and more time engaged in so-called near-vision. *(*Joshua Foreman,*et.al.*,2021*)*

2.6 CANCER RISK

Mobile phones emit radiofrequency electromagnetic radiation. It is non-ionizing radiation which is dissimilar than ionizing radiation like alpha, beta rays that can change the chemical bond and cause damage to the DNA. But they are likely absorbed by the tissues in our which may cause any tissue heating effects Radiofrequency from mobile phones are stronger than the FM radio signal which may cause cancer. And while talking through mobile phones it is held closely to the ear which is near the head. The heat produced from mobile phones may cause any damage if it is used prolonged. Certain studies have been conducted to see the relation between mobile phone usage and cancer. In Amritsar, Punjab, India, a study was conducted to see the relation between mobile phone use, and DNA and chromosomal damage in lymphocytes of mobile phones users were observed. Such damages can have long-term consequences in terms of increased risk of neoplasia or other age-related changes (Volkow,*et al.*,2007). But there is no scientific proof by the researchers that mobile phones can cause cancer. At the same time excessive use of mobile phones should be avoided and cautious to prevent cancer.

It is a mass of tissue which is abnormal and in this condition the body cells die and replaced by the cells and other tumors. The abnormal cells grow and they produce a flock which is named as the main neoplasm. These come out of the several cells, which constitute the brain, CNS (Central Nervous System). There are several cases of brain tumors such as astrocytic and the gliomas tumors. There are two types of Brain Tumor: Malignant Tumor (Cancerous Tumor): The malignant tumor is a cancerous tumor that is either primary or secondary. The malignant tumor can be elementary or secondary brain tumors. It starts in the mind. The primary malignant brain tumor is fast growing tumor than the secondary malignant brain tumor where immediate treatment is important for primary malignant tumors because it can open rapidly and damages the spinal cord and other regions of the head.(Suhag ,*et.al*.,2016)

2.7 MALE INFERITILITY:

The reproduction is a lifelike experience for couples. Nevertheless, it is very hard to contrive for the child. Basically the infertility is a wider problem in the universe due to different causes. The male infertility problem creates the sperm production (sperm production in low number) or the transfer process of sperm. The infertility problems are sperm motility, sperm count, sperm morphology, functions of sperm, impaired Leydig cell, Sertoli cell, abnormality of sperms, to stop delivery of sperm, a chronic health problem (Dohle (2016). The causal agent of male infertility is because of testicular impairment resulting in the testicles not producing the sperm cells, the infertility of man includes the imbalance of hormone, behavioral problem

and psychological troubles. The negative impacts on male fertility are smoking, use of drugs, alcohol abuse, tight underwear, radiation exposure, pesticides, paint, lead, and radioactive (Hamada, *et.al*.,2011)

2.8 ORGAN RISK

Nowadays social media has created a serious impact on humans but sticking to it all the time. This addiction leads to prolonged use of mobile phones which may cause serious psychological effects like eyes dryness, eyesight problems, wrist and thumb pain, muscular pain, neck pain, insomnia, delusions, sleep disturbance, stress, hallucination, lower self-confidence, increased frequency of De Quervain's tenosynovitis (Parasuraman,*et.al.,* 2017).

Mobile phones provide heat on over-usage which may cause adverse health effect which is reported in a study that when mobile phones are kept close to the chest it increases the heart rate and decreases when kept close to the head, but this is not convincing in comparison to conditions without using mobile phone. But again researchers haven't suggested any valid evidence of adverse health effects from exposure to radiofrequency fields except the tissue heating effect (Röösli 2008).

2.9 MUSCULOSKELETAL COMPLAINS/ DISORDERS

Over-usage of mobile phones will be of different angles and types where head angle will be tilted, change in the wrist, thumb and hand movement, neck position which will create pain. This depends on the task, posture, and position of holding the smartphone. Several studies have suggested that neck pain caused while using a mobile phone will make us adopt a flexed position which causes a negative effect on musculoskeletal problems. There is a huge difference in using a mobile phone while sitting and standing. The head-neck angle shift is higher in a sitting position than that while standing. (Eitivipart, *et.al*., 2018). The faulty posture of the head and neck will cause serious effects in the ligament alignment, cervical pain, and respiration dysfunction (Jung ,*et. al*.,2018)

2.10 CORRELATION BETWEEN MUSCULOSKELETAL DISORDER AND LEVELS OF ERGONOMIC RISK AMONG SMARTPHONE USERS

While using mobile phones there will some flexed position like neck, shoulder, elbow, wrist, hand flexion when typing, with their hand and wrist to support the phone while upper and lower back, hip and thigh and ankle and foot neutral was also flexed (Namwongsa, *et. al.*,2017).

These position adopted while using mobile phones will surely make adverse affect in the body (Lee JH, *et.al.*,2014). If the awkward position continues it will cause strain in the muscle and make change in the ligaments around the joint also nerve issues. Such positions like head-neck tiled angle, arm raising can lead to ergonomic problems which affect he ergonomics risk (Chaiklieng S,*et.al.*,2016). From this we can understand there is a significant correlation between the smartphone usage and musculoskeletal disorder may cause due to flexed awkward position which leads to the increase in the levels of ergonomic risk.

2.11 THE CONSEQUENCES OF SAMRT PHONE USAGE:

Baker, Lusk and Neuhauser (2012) said faculty members should address the use of electronic devices in the classroom in their syllabi. No present theory addresses this, but offers an important avenue the appropriateness of electronic devices in the classroom. According to Hanson, Drumheller, Mallard, McKee and Schlegel (2011) students in the library used email, instant messaging and web-surfing rather than checking the library's online resources. Although students want to make academics a priority, they have a difficult time balancing their school life with their need for financial and social support. It was found that students focus more on updating their Facebook status than downloading their homework assignments.

2.12 EFFECT ON SLEEP

Sleep interruptions and sleepiness are among the most broadly detailed mobile phone related medical issues (Loughran,*et.al*.,2011). The use of mobile phones has become (a need for many individuals all through the world since the present actually progressed cell phones are equipped for accepting calls as well as to store information, sending and getting records and so on important, particularly among the young. This has led to psychological dependence on mobile phones, which results in addiction to it. Excessive use of mobile phones is considered to be associated with headaches, earache, warmth sensations, and even perceived difficulties in concentrating on anything. Various studies have also shown that most smartphone users suffer from sleep deprivation and intensified stress impacting their cognitive and learning skills (H. GJ, K.*et.al*.,2017). Presently mobile phone use is a typical practice for some youthful grown-ups before sleep time or even after lights-outs. This undesirable propensity can prompt deferred sleep time, absence of rest, unpredictable sleep wake cycles, helpless sleep quality, and expanded exhaustion during the day. Also, social media or games may initiate hyperarousal pre-sleep. According to several studies sleep disorders were associated with mood deficits, and sleep loss led to anger, confusion, anxiety, and depression (He J-W,*et.al*.,2020). Sleep is an essential need that constitutes almost one-third of the hours in a human's lifetime. It is a

condition of reversible obviousness, where the body and brain arere-established, fixed, and created (Karadağ,*et.al*.,2017).

2.13 PHYSICAL EFFECTS OF ADDICTION :

Overuse of smartphone can result in a number of different physical problems that may cause permanent damage or be difficult to treat, including: Digital eye strain, Neck problems, Car accidents, Male infertility (Moieeson Thairiyam, *et.al*.,2018)

2.14 EAR HEARING DISABILITY:

Hearing problem usually develops according to the age and it can occur due to the loud disturbance. In that respect are different cases of hearing problems which creates trouble in hearing means the people cannot listen clearly and they continue on asking people again and again. One of the cause of hearing loss is listening to the music with high bulk. The classification of hearing loss can be sensory, conductive, neural, mixed hearing loss. The hearing loss may be one-sided (single spike) or may be bilateral (both ears). That point having some degree losses that are (Deaf/Deafness, Hard of hearing, Hearing Impaired, Residual hearing (Rana RK,*et.al*.,2010).

2.15 THE RISE OF MOBILE ADDICT:

According to Simon Khalafons' article in 2014, in May of 2013, KPCB's Partner and world-renowned analyst Mary Meeker shared an interesting statistics Internet Trends Report: "The over usage mobile consumer checks their device 150 times a day". Flurry Analytics used refer to as the "Mobile Addict":52% female and 48% male, compared to 48% female and 52% male for average mobile users. The 8% number is significant: In the total Mobile Addict population of 176 million, 15 million more female Mobile Addicts than male Mobile Addicts". The Mobile Addict segment over indexed on the 13-17 (Teens), 18-24 (College Students) and 35-54 (Middle Aged) age segments. Middle Aged consumers constituted 28% but only constituted 20% of the average mobile **consumer.**

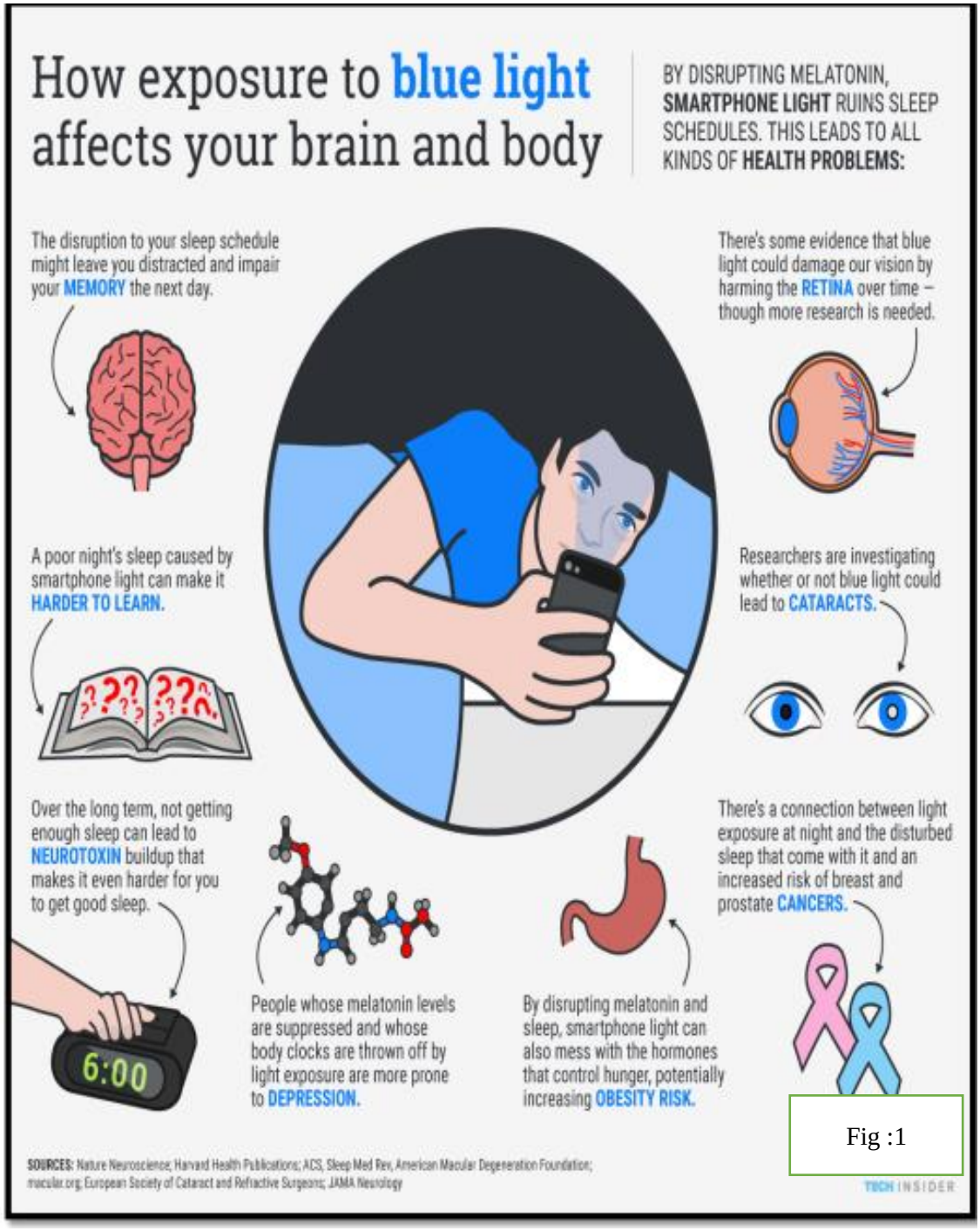


Fig :1

Source: Nature of Neuroscience; Harvard Health Publications; ACS, Sleep Med Rev, American Molecular Degeneration Foundation; macular.org; European Society of Cataract and Refractive Surgeons; JAMA Neurology

Experimental Procedure

3
Experimental procedure

Smartphone use has become ubiquitous over the past decade. This has been accompanied by growing concerns around excessive and potentially harmful use. There are emerging reports of problematic behaviour patterns in relation to smartphone use which mirror those of addiction. Over usage of mobile phones may cause psychological illness such as dry eyes, computer vision syndrome, weakness of thumb and wrist, neck pain and rigidity, increased frequency of De Quervain's tenosynovitis, tactile hallucinations, nomophobia, insecurity, delusions, auditory sleep disturbances, insomnia, hallucinations, lower self-confidence, and mobile phone addiction disorders (Peraman R,*et al ,201)6*. Hence this study aimed to assess the level of oxidative biomarkers among extensive usage of mobile phone and to explore self-reported symptoms of participants and its associated complications with respect to extensive usage of mobile phone.

As a preliminary study, an online survey was conducted between November 2021-December 2021. Questionnaire was prepared and online survey method was carried out to collect the data including demographic details, habituation, previous awareness on mobile phone hazards and addiction behaviour of the participants. Number of participants attended 90.

Statistical analysis was performed using SPSS 25 to analyse the data of participants based on the gender and the results were summarized.

Oxidative stress reflects an imbalance between the systemic manifestation of reactive oxygen species and the level of antioxidants defense system. In humans, Oxidative stress is thought to be involved in the development of cancer, Parkinson's disease, atherosclerosis, heart failure and myocardial infarction (Devasagayam, 2004). The Oxidative damage is tested by the increase in lipid peroxidation formation.

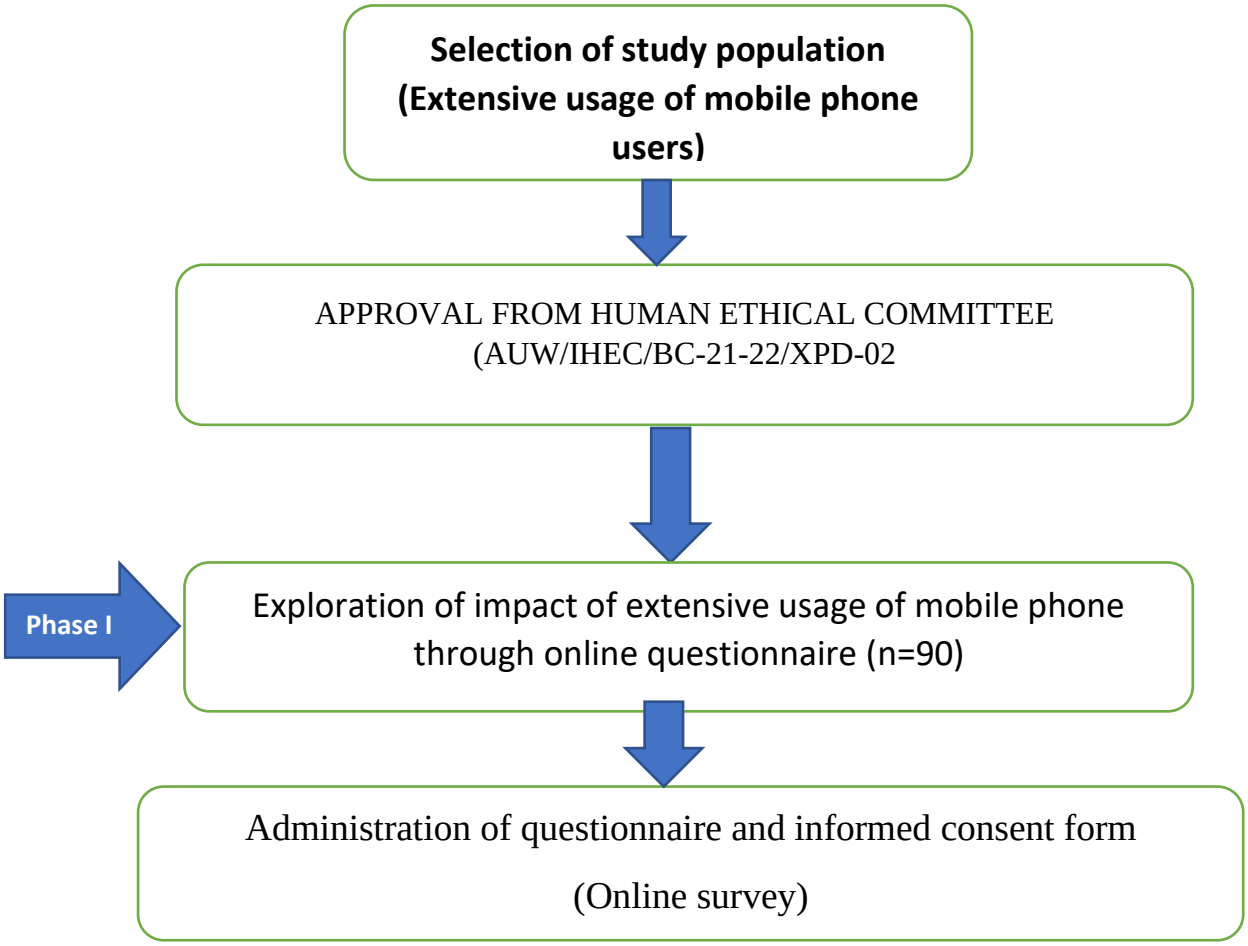
Among the cellular molecules, Lipids contain more than one double bond susceptible to action of free radicals. The resulting reaction is known as lipid peroxidation which produces a large number of by products being studied in relation to disease. These by products being studied in relation to diseases. These by products can be measured by the estimation of aldehyde products using thiobarbituric acid (Devasagayam,2003). Heavy metals induce an increased production of malondialdehyde (MDA), an indicator of lipid peroxidation and whole

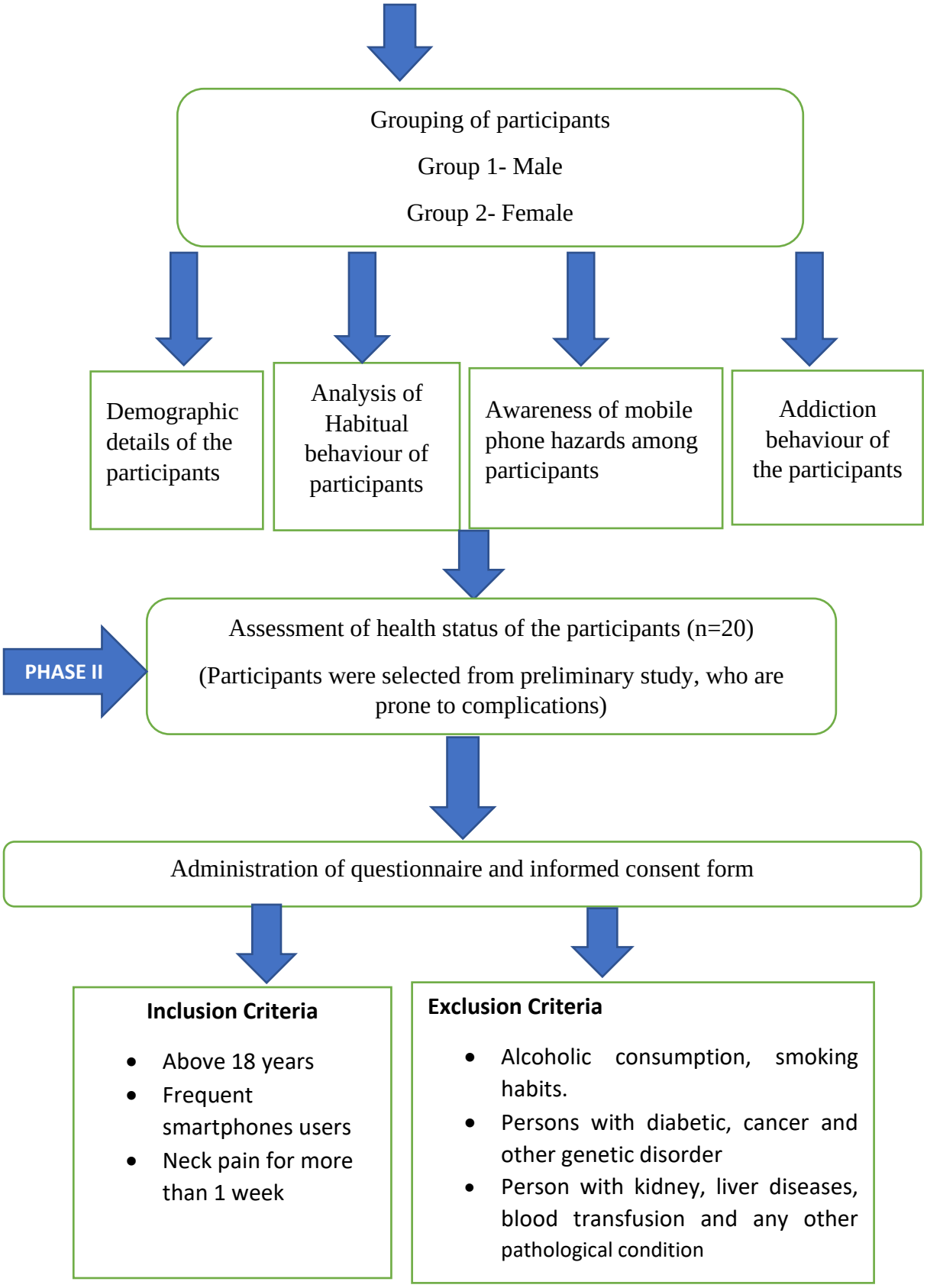
body free radical activity (Flora *et al*.,2008). High levels of lipid peroxides are associated with cancer, heart disease, stroke and adding.

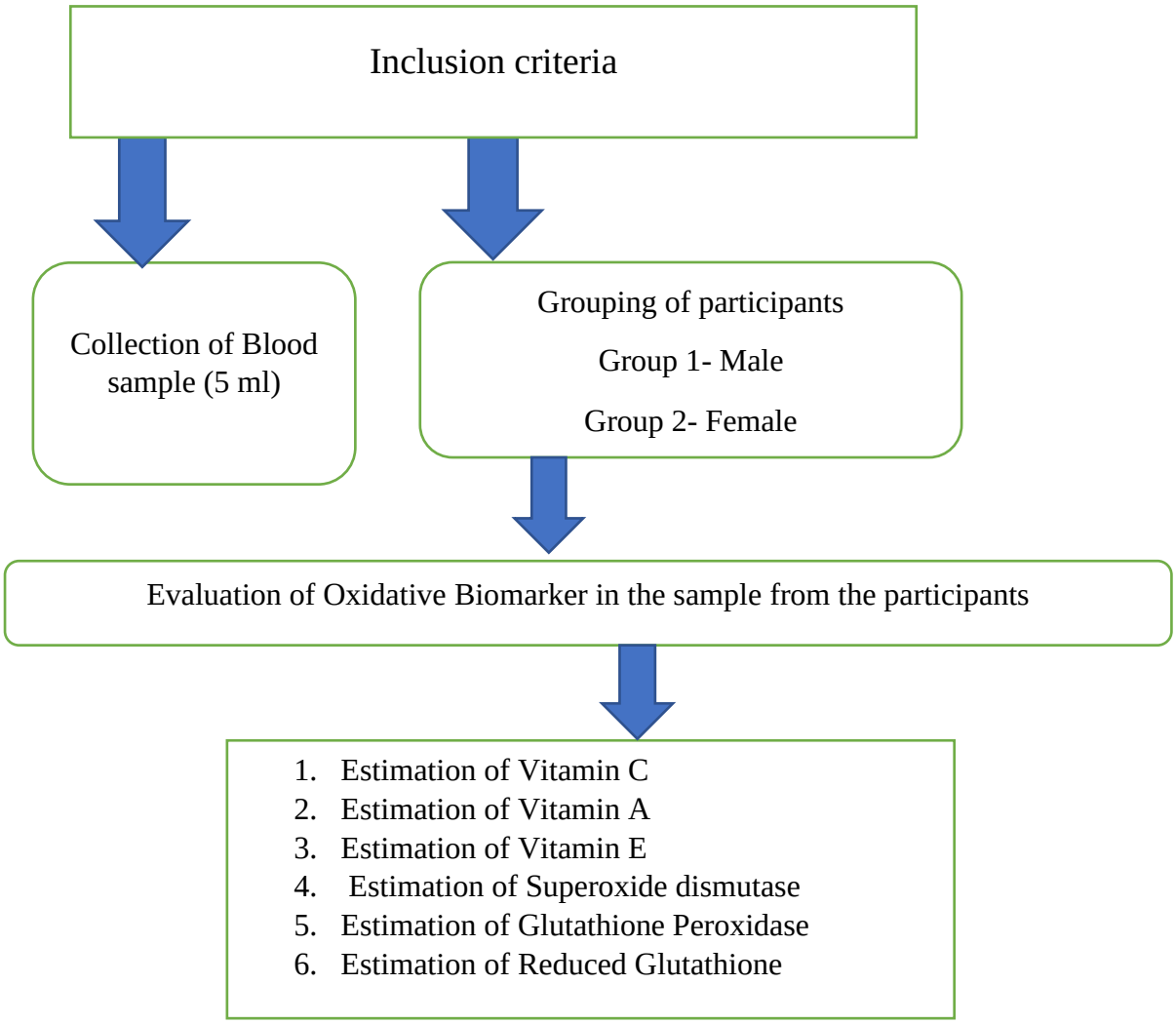
Antioxidants are the compounds that protect the body against toxic effect of free radicals. The protective mechanisms of antioxidants serve to scavenge the free radicals. Different antioxidants act at different levels: They may prevent initiation of chain reaction by removing free radicals (preventive Antioxidants). They may scavenge free radicals generated in chain reaction, there by interrupting the chain sequences (chain breaking). They may remove peroxides, thereby preventing further generation of reactive oxygen species (ROS). Types of antioxidant system such as Enzymes antioxidant system, Vitamins antioxidant system, Minerals antioxidant system. (Sei You Sohn *et al*.,2019).

Based on the above facts, Evaluation of oxidative biomarkers was conducted in peripheral blood plasma to find out the relationship between the self-reported symptoms on over use of mobile phones with the level of oxidative biomarkers.

WORK PLAN:




Grouping of participants
Group 1- Male
Group 2- Female
Demographic details of the participants
Analysis of Habitual behaviour of participants
Awareness of mobile phone hazards among participants
Addiction behaviour of the participants
PHASE II
Assessment of health status of the participants (n=20)
(Participants were selected from preliminary study, who are prone to complications)
Administration of questionnaire and informed consent form
Inclusion Criteria
Above 18 years
Frequent smartphones users
Neck pain for more than 1 week
Exclusion Criteria
Alcoholic consumption, smoking habits.
Persons with diabetic, cancer and other genetic disorder
Person with kidney, liver diseases, blood transfusion and any other pathological condition



The Experimental design adopted in the study "Evaluation of oxidative biomarkers in relation with the self-reported symptoms among over-usage of smart phone users on the basis of Gender" was conducted in two phases and it is discussed under the following headings:

PHASE I

3.1 EXPLORATION OF IMPACT OF EXTENSIVE USAGE OF MOBILE PHONE THROUGH ONLINE QUESTIONNAIRE

3.1.1 Survey conducted through online among participants based on Gender

3.1.2 Demographic profile of the participants

3.1.3 Analysis of Habitual Behaviour of the participants

3.1.4 Addiction Behaviour of the participants

3.1.5 Awareness of mobile phone hazards among participants

PHASE II

3.2 Evaluation of oxidative markers of mobile phone users

3.2.1 Study population

3.2.2 Administration of questionnaire and informed consent form

3.2.3 Collection of blood sample

3.2.4 Grouping of participants based on Gender

3.2.5 Assessment of oxidative biomarkers among participants

3.2.5.1 Estimation of superoxide dismutase

3.2.5.2 Estimation of Glutathione peroxidase

3.2.5.3 Estimation of Reduced glutathione

3.2.5.4 Estimation of Vitamin A

3.2.5.5 Estimation of Vitamin E

3.2.5.6 Estimation of Vitamin C

3.2.6 Statistical analysis

PHASE I

3.1 Evaluation of the health status and oxidative markers of mobile phone users

Questionnaire was prepared in the form of google form which was composed of 36 questions self-designed by the investigators. The link of the questionnaire was forward to people through social media to the contacts of investigator. Participants were encouraged to roll of questionnaire to as many contacts as taken.

3.1.1 Survey conducted through online among participants based on Gender

Questionnaire is prepared and shared among the participants. Participants are divided into two groups as Group 1 (Female) and Group 2 (Male). Conducted in the form of online survey among the participants. (Annexure 1)

The following information were obtained from the participants

3.1.2 Demographic profile of the participants

Demographic details talk about the detailed note on age, gender, academic qualification. accommodation, Occupation of the participants. It collects the personal details of the people.

3.1.3 Analysis of Habitual behaviour of participants

Habituation details talks about the years of mobile phones usage, duration of mobile phone usage per day, posture of mobile phone usage and also involve the medications details

3.1.4 Addiction Behaviour of the participants

Addiction behaviour collects details about how participants are addicted towards mobile phone. It is a kind of self-analysis of how participants are addicted. It includes questions like how much time they spend on mobile phone, frequency of checking mobile phones, missing social life.

3.1.5 Awareness of mobile phone hazards among participants

Analysis of awareness gives detailed information about how people are aware of mobile phone usage ill effects. It includes questions like awareness on EMR, neck pain, ear discomfort.

3.2 EVALUATION OF OXIDATIVE BIOMARKERS OF MOBILE PHONE USERS

Google form was created to collect data from the participants in which physical and mental health status of participants were determined (n=90). On extensive usage of mobile phone, it is observed that it leads to many health complications.

From the preliminary study specific participants those who are prone to complications on over usage of mobile phones are selected for the study (n=20). Those participants sample are collected oxidative biomarkers are determined.

3.2.1 STUDY POPULATION

A cross sectional study was conducted among the participants in (Renga nagar, Periyanakenplayam Coimbatore), Samples along with details of participants are taken from the

Renga nagar area with the permission of area counsellor Mr.J. Pon Madasamy, on basis of the Gender.

The study protocol is approved by Human Ethical Committee (AUW/IHEC/BC-21-22/XPD-02) of Avinashilingam institute for Home Science and Higher Education for Women, Coimbatore, Tamil Nadu. (Annexure 2)

3.2.2 ADMINISTRATION OF QUESTIONNAIRE AND INFORMED CONSENT FORM

Each study subject received a questionnaire and was orally explained about the project and the questions asked in questionnaire. Before the sample collection the participants are signed in the informed consent form. (Appendix-1)

The study was designed with selected inclusion and exclusion criteria for the selection of participants

Inclusion criteria:

- Above 18 years
- Frequent smartphone users
- Neck pain for more than 15 days

Exclusion criteria:

- Alcoholic consumption, smoking habits
- Persons with diabetic, Cancer and other genetic disorder
- Persons with kidney, liver diseases, blood transfusion and any other pathological condition.

A prospective study observes for outcome, such as the development of disease, during study period and relates this to other factors such as suspected risk or protection factors. Participants with known history of diabetes mellitus, kidney and liver diseases, blood transfusion and any other pathological conditions are excluded from the study because these known factors may obstruct the findings of outcome of the results. Participants who were less than eighteen years were not included due to ethical measures.

3.2.3 COLLECTION OF BLOOD SAMPLE

Peripheral venous blood samples (5ml) were collected from the subjects. All the samples are collected Vacutainers (AcCuvet-PLUS with clot activator) were centrifuged at 3000rpm at 4℃ for 10 minutes. The samples were aliquoted into labelled cryovials and stored at -20℃ for further analysis.

3.2.4 GROUPING OF PARTICIPANTS ON BASIS OF GENDER

Based on the information collected from the participants they were further categorized into two groups as Group 1 (Female), Group 2 (Male).

3.2.5 ASSESSMENT OF OXIDATIVE MARKERS AMONG PARTICIPANTS

Antioxidants are substances that can prevent or slow damage to cells caused by free radicals, unstable molecules that the body produces as a reaction to environmental and other pressures. They are sometimes called as free radical scavengers. Free radicals are waste substances produced as the body processes food and reacts to the environment. If the body cannot process and remove free radicals efficiently, oxidative stress can result. This can harm cells and body function. Free radicals are also known as reactive oxygen species (ROS).

3.2.5.1 Estimation of superoxide dismutase

Superoxide dismutase (SODs) are universal enzymes of organisms that live in the presence of oxygen. They catalyse the conversion of superoxide into oxygen and hydrogen peroxide. It speeds up certain chemical reaction in the body (Appendix 2).

3.2.5.2 Estimation of Glutathione peroxidase

Direct measurement of liberated free radical species is limited by their instability, the level of malondialdehyde (MDA), the stable product of oxidative degradation of polyunsaturated fatty acids, has been widely adopted as a measure of free radical formation. In previous study (Muû·kov· et al. 2000), an increase of the serum MDA in reperfused patients with AMI was found shortly after successful thrombolytic treatment. The increase was followed by rapid transient stimulation of plasma GPx activity (Appendix 3).

3.2.5.3 Estimation of Reduced glutathione

Reduced glutathione is an antioxidant that protects the cells from damage caused by free radicals, heavy metals, and lipid peroxides. It can come as L-Glutathione reduced (GSH) or in

an inactive state (GSSH). The ratio of reduced glutathione to oxidized glutathione within cells is a measure of cellular oxidative stress. In healthy cells and tissue, more than 90% of the total glutathione pool is in the reduced form (GSH), with the remainder in the disulfide form (GSSG) (Appendix 4).

3.2.5.4 Estimation of Vitamin A

Beta-carotene, another important lipid soluble membrane-bound antioxidant, is able to quench singlet oxygen interrupting the generation of ROS at a very early stage (Appendix 5).

3.2.5.5 Estimation of Vitamin E

Alpha-tocopherol is the major lipid soluble antioxidant which is present in the blood, mainly in the VLDL and LDL fractions, where it prevents free radicals to oxidize these lipoproteins. When incorporated into the membranes, α-tocopherol protects myocardial phospholipids (Gutteridge 1995) (Appendix 6).

3.2.5.6 Estimation of Vitamin C

Vitamin C in humans must be ingested for survival. Vitamin C is an electron donor, and this property accounts for all its known functions. As an electron donor, vitamin C is a potent water-soluble antioxidant in humans. Human diseases such as atherosclerosis and cancer might occur in part from oxidant damage to tissue (Appendix 7).

3.2.6 STATISTICAL ANALYSIS

SPSS package version 25.0 was used for the statistical analysis of data. SPSS (Statistical Package for the Social Sciences) is the set of software programs that are combined together in a single package. The basic application of this program is to analyse scientific data related with the social science. This data can be used for market research, survey, data mining, etc. The statistical level was set at $p<0.05$. Independent T test and chi square test were performed for normally distributed data and if the data variation at significant level ($p<0.05$),

Results and Discussion

4

Results and discussion

Mobile phone has become an integral part of modern communication in every individual. Over usage of technology leads to addiction. Currently, the addiction to smartphones among students is 24.8%–27.8%, and it is progressively increasing every year (Jeong, Lee., 2015). At the same time extensive usage of mobile phones leads to Self-reported symptoms associated with using mobile phones most commonly include headaches, earache, wrist pain and warmth sensations (Korpinen, Pääkkönen., 2009) and sometimes also perceived concentration difficulties and fatigue (Johansson *et al*., 2010). However, EMF exposure due to mobile phone use is not currently known to have any major health effects. Researchers are studying tumour of the brain and central nervous system and other sites of the head and neck because mobile phones are typically held next to the head when used (National Cancer Institute, 2011)

Most smartphone tasks require users to stare sharply downwards and hold their arms out in front of them to see the screen, which makes the head move forward and causes an excessive anterior curve in the lower cervical vertebrae and an excessive posterior curve in the upper thoracic vertebrae to maintain balance (Kang *et al*., 2012), (Berolo *et al*., 2011), (Szeto *et al*., 2002). This is known a head posture (FHP; turtle neck posture) and may impose exaggerated stresses on the cervical spine and neck muscles. Longer use was significantly associated with smartphone addiction, which is consistent with other studies that have found that increased exposure is linked with increased dependency (Cha *et al*., 2019) Park & Lee (2012) also reported that smartphone use could be attributed to loneliness, depression and self-esteem based on their smartphone use and psychological well-being study. Mobile phones emit blue rays which on usage on low light can affect the human eye and has the high chance of having eye problem, eye irritation, sleeplessness, insomnia, redness in eyes, and may also cause myopia

The Lockdown scenario due to COVID′ 19 has compelled people to adapt to the remote mode of working with the help of technology. Several literature studies have confirmed the adverse effects of excessive use of technology on human health (Antonio Moreno-Llamas *et al*., 2020), (Deblina Roy *et al*., 2020), (Auvinen *et al*., 2019).

Younger people tend to use mobile phones higher than the old people. It has some working protocol where younger adult can easily adapt that, however still old people are trying learn the protocol to access the mobile phone. The biggest age-related difference lays in connectivity. Younger adults rated connectivity to computers and other devices and Internet access much higher than older adults (Cia Zhou., 2019).

Kesari *et al*. (2013) concluded that the mobile phone radiation and usage may increase the reactive oxygen species, which plays an important role in the development of metabolic and neurodegenerative diseases. Hence evaluation of oxidative biomarkers was conducted in the peripheral blood plasma of study volunteers to know the level of oxidative biomarkers in relation with the self-reported symptoms caused due to the extensive use of mobile phones. The results of the present study are discussed under the following headings:

PHASE 1

4.1. EXPLORATION OF IMPACT OF EXTENSIVE USAGE OF MOBILE PHONE THROUGH ONLINE QUESTIONNAIRE

4.1.1 Preparation of questionnaire based on over usage of mobile phones, its addiction and complication

4.1.2 Survey conducted through online among participants based on gender

4.1.3 Statistical Analysis

4.1.4 Demographic profile of the participants

4.1.5 Analysis of Habitual behaviour of the Participants

4.1.6 Awareness of mobile phone hazards among participants

4.1.7 Addiction Behaviour of the Participants

PHASE 2

4.2 **EVALUATION OF BIOMARKERS OF STUDY VOLUNTEERS**

4.2.1 Estimation of superoxide dismutase

4.2.2 Estimation of Glutathione peroxidase

4.2.3 Estimation of Reduced glutathione

4.2.4 Estimation of Vitamin A

4.2.5 Estimation of Vitamin E

4.2.6 Estimation of Vitamin C

PHASE 1

4.1. **EXPLORATION OF IMPACT OF EXTENSIVE USAGE OF MOBILE PHONE THROUGH ONLINE QUESTIONNAIRE**

4.1.1 Preparation of questionnaire based on over usage of mobile phones, its addiction and complication

Questionnaire was prepared and it was categorised under four topics namely demographic details of the participants which include the personal details of the participant like name, age, gender, height, weight, educational qualification, accommodation. Habituation includes the questions like neck pain, occurrence of neck pain, sleeping position, degree of mobile phones usage, duration of sleeping time etc. Addiction behaviour complies the information regarding the addiction behaviour caused due to the extensive use of mobile phones like missing planned works, missing social life, feeling too much of time engaged on using mobile phone. And Awareness related questions namely EMR, neck pain occurrence, ear discomfort etc. were included.

4.1.2 Survey conducted through online among participants based on Gender

Survey was conducted through online mode, where the questionnaire was distributed through social media. About 90 people of various age and genders are participated in this online survey to maintain social distancing during the time of pandemic. The mode of conducting the survey was chosen to be online to maintain social distancing during the time of

the Pandemic. A questionnaire was prepared in the form of Google Form which was composed of 36 questions self-designed by the investigators. The link of the questionnaire was forwarded to people email, WhatsApp, and Facebook to the contacts of investigators. Participants were encouraged to roll out the questionnaire to as many contacts as Table 1 includes specification of the participants like age, gender, height, weight, blood pressure, qualification, accommodation etc. Participants belonged to different ages ranging from 18 to 50 were participated. To obtain a more precise analysis, genders and work experience was divided into subgroups and small ranges. Moreover, the survey was limited to an educated class of people who know English, as, a questionnaire was framed in the English language. The following section describes and discusses about the information collected from the questionnaire and the statistical analysis. SPSS 25.O was used for the analysis of data.

4.1.3 Statistical Analysis

Statistical package for the social sciences (SPSS) is a easy software for analyzing data and running the statistical tests. It is versatile program used to analyse the data. Chi-square is a statistical test used to examine the differences between categorical variables from a random sample in order to judge goodness of fit between expected and observed results. Phi and Crammers and correlation was used to find the significance among participants.

4.1.4 Demographic profile of the participants

The study participants' demographic details are summarized in (Table 1)

About 99% of the study participants were using smart phones, with 93.7% of them having at least one mobile phone. Most of the study participants used mobile phone for more than 5 years. Around 22.2% of the study participants use mobile phone for an hour (approximately) and remaining use it for more than an hour. Nearly 36.7% of the study participants have the habit of checking mobile phones in between sleep, while 27.1% felt inconvenience with mobile phone use. Majority of the respondents were using mobile phone for communication purposes 50.8%, Social media 63.5% entertainment 54% and educational/academic purposes .

TABLE 1: Demographic profile of study participants

Variables	(n=89)	Female (n=43)	Male (n=46)	P value ∗

Academic Qualification				0.533
School	12	4	8	
Undergraduate	37	9	18	
Postgraduate	38	19	19	
Occupation				0.083
Student	46	26	20	
Working	31	10	21	
Non-working	10	6	4	
Accommodation				0.083
Home	71	32	39	
Hostel	16	10	6	

∗Chi square test was prepared ($p<0.05$)

4.1.5: Analysis of habitual behaviour of the participants

TABLE 2 :Analysis of habitual behaviour of the participants

Habits of mobile phone usage among the study participants are summarized in Table 2

Variables	(n=89)	Female (n=43)	Male(n=46)	P value∗
Type of mobile phone usage				**0.598**
Smart phone	84	41	43	
Basic phone	3	7	2	
Both	0	0	0	
Mobile phone user				**0.086**
Yes	86	42	44	
No	1	0	1	
No. of years of mobile phone usage by study participants				**0.314**
<5	45	26	19	
6-10	34	12	22	
10-15	6	4	2	
15-20	2	0	2	

Duration of mobile phone usage per day				**0.033**
< 1 hour	8	5	3	
1-2 hour	20	10	10	
3-6 hour	37	20	17	
More than 6 hour	22	7	15	
Frequency of mobile phone usage				**0.042**
Frequent	58	30	28	
Rare	29	12	17	
Checking of mobile phone in between sleep				**0.217**
Yes	23	9	14	
No	56	27	29	
Rare	8	6	2	
Posture of mobile usage				**0.045**
0 degree	8	4	4	
10 degree	28	18	10	
30 degree	31	10	21	
45 degree	15	8	7	
60 degree	5	2	3	
Any medication for neck pain?				**0.148**
Own medication	11	3	8	
Doctorprescribedmedicine	7	2	5	
none	69	37	32	
Preference of medication				**0.032**
Tablets	13	5	8	
Ointment	7	2	5	

Spray	54	31	23	
Physical therapy	7	3	4	
Have undergone any neck pain on over usage of mobile phone				**0.055**
Yes	39	17	22	
No	48	25	23	
Occurrence of neck pain				**0.305**
Rare	73	37	36	
Common	14	5	9	
Total sleeping time				**0.037**
Below 5	70	31	39	
6-8	6	4	2	
Above 8	11	7	7	

∗Chi square test was performed ($p<0.05$)

Habituation gives report of how participants are engaged with mobile phones and their usage. From table 2 we can see that most of them are using smartphones which has so many features where it makes people to engaged with it for a long period of time. 98% participants were using smart phones and 2% were using both. Very smaller number of participants were having sleeping time less than five hours (4%) and major participants like to use mobile phones largely at night time.1n 70% of participants is found to be having sleep of less than 5 hours a day in this 50 % of participants are Group 2 (male).Very a smaller number of participants are having proper 8 hours of sleep a day. As most of the participants were students 1 to 5 years of mobile phone usage is higher (45%). 34% participants were using for about 6 to 10 years and 11-15 years (6%) ,above 15 (2%) were belongs to Group 2(male). It is also found that participants have the (58%) habit of checking mobile phone frequently where surprisingly both the group 1(Female) 30% and group 2(Male) 28% . 29% of participants have the habit of checking mobile phones rare. It shows a significance value 0.045, it is less than p value (0.05). Very small number of participants have reported that they use mobile phones less than 1 hour. 20% are using 1-2 hours, 37% use mobile phones for 3 to 6 hours, where 20% belongs to group 1(Female) and 17% belongs to group 2(male). 22% of participants are using mobile phones for

more than 6 hours. Here along with group 1 (Female) (7%) and group 2(male) (15%) are using mobile phones for more than 6 hours .This shows the dependency of participants towards mobile phone extensively. Mobile phone posture includes 8% 0 degree, 28% 15 degree, 31% 30 degree, 15% 45degree and 5% 60 degrees.

4.1.6 Awareness of mobile phone hazards among participants

TABLE 3: Awareness of mobile phone hazards among participants

Variables	(n=89)	Female (n=43)	Male (n=46)	P value*
Place of hand phone keeping				0.04
In bag	53	30	23	
Around pelvic area	6	5	1	
Around neck area	28	7	12	
Awareness about EMR				0.076
Yes	64	31	33	
No	53	11	12	
Feeling of any discomfort while using mobile phone				0.043
Yes	34	12	22	
No	53	30	23	
Having pain in wrist and hand because of smartphone				0.407
Yes	34	12	20	
No	53	30	25	
Felt any ear discomfort which using mobile phone ?				0.038
Yes	28	9	19	

No	**59**	**33**	**26**	
Sleeping position				**0.790**
Back	**41**	**21**	**20**	
Side	**19**	**9**	**10**	
Fetal position	**23**	**11**	**12**	
Stomach	**4**	**1**	**3**	

∗Chi square test was prepared ($p<0.05$)

Awareness related question enquires about the pain, discomfort of the participants on extensive usage of mobile phone. From the questionnaire it is found that maximum number (64%) of population are aware of Electro Magnetic Radiation. It shows significance 0.076 it is less than p value (0.05). For sleeping position most of the participants prefer side 41%, back and stomach 23% and foetal 19%. Participants having wrist pain or hand pain is less in group 1(Female) where 34% of participants have reported that they undergone wrist and hand pain while using mobile phone. It shows significance value of 0.043 where it is lesser than $P< 0.05$. And moreover, participants feeling discomfort in very less number in group 1(Female) than group 2(male). This as well as shows significance value of 0.043 which is lesser than the p value $p<0.05$. Group 2(male) 33% haven't undergone any ear discomfort while using mobile phone. 28% of age group 1(Female) have undergone ear discomfort on extensive use of mobile phone.

4.1.7 Addiction behaviour of the participants on over usage of mobile phone

TABLE 4: Addiction behaviour of the participants on over usage of mobile phone

Variables	**(n=89)**	**Female (n=43)**	**Male (n=46)**	**P value∗**
Finding too much of time are engaged with mobile phone ?				**0.047**
Yes	50	21	29	
No	37	21	16	

Missing planned work because of mobile phone use?				0.141
Yes	36	14	22	
No	51	28	23	
Using of mobile phone causes any mental or Pscychological disturbance?				**0.028**
Yes	63	35	28	
No	24	17	7	
Feeling of missing normal social life on usage of mobile phone?				0.035
Yes	48	16	32	
N0	39	20	19	

∗Chi square test was prepared ($p<0.05$)

Addiction behaviour analysis shows the participants dependency towards the mobile phone. It is found that 50% of participants finding too much of time engaged in using mobile phones and 37% saying No. Minimum number of participants 36% have said that missing planned work because of extensive usage of mobile phones. 51% of participants reported that they are not missing planned works because of mobile phones. It is as well as found that out of 51%, 28% of group 1(female) participants have said they are not missing any plans, which portray they are not dependent on mobile phones. Mostly people due to addiction behaviour they keep on scrolling social media or play games which occupy most of their time where they become lazy and schedule all the works later. This leads to missing of planned works higher in group 2(male). Using mobile phones cause psychological disturbance shows significance of 0.028 which is lesser than $p<0.05$, 63% said yes and 24% said No. Group 2 (male) participants are less prone to psychological disturbance compared to Group 1(Female) people. This could be due to not getting reply immediately, network issue, relationship problems they take it so seriously and may feel depression, anxiety, worried. Missing of normal social life due to extensive usage of mobile are seen more in Group2(male) than Group 1(Female). It also shows significance 0.035 which is lesser then the P value ($P<0.05$).

4.2 EVALUATION OF BIOMARKERS OF STUDY VOLUNTEERS

From the results of preliminary study 20 samples were collected from study volunteers. It is collected in a such a way 10 samples from Group 1(Female) and 10 samples from Group 2(male). Blood sample (5.0 ml) was collected and following antioxidant assay have been estimated. The samples were corelated with the standard and regression graph was framed. The data were in the SPSS version 25.O. Independent student t test is used for analysis and the results were summarized as follows;

Figure 2 Collection of blood sample from the participant

Figure 3 Blood sample before centrifugation

4.2.1 Estimation Superoxide dismutase

Superoxide dismutase (SODs) constitute a very important antioxidant defence against oxidative stress in the body. The enzyme acts as a good therapeutical agent against reactive oxygen species.

Superoxide dismutase uses the photochemical reduction of riboflavin as oxygen generating systems and catalyses the inhibition of Nitro Blue Tetrazolium (NBT) reduction, the extent of which can be assayed spectrophotometrically at 600nm.

From independent sample test we could find that no significance difference was observed ($p=0.671$) where, it is greater than the p value $P<0.05$. From figure 4 it is found that there is a significant change in the level of oxidative biomarkers, superoxide dismutase between

two groups. Group 1 people (female) are more vulnerable on using mobile phones which can be clearly identified from the chart in (figure 4). Whereas Group 2 (male) are esser then Group 1 (female) in the level of oxidative biomarker

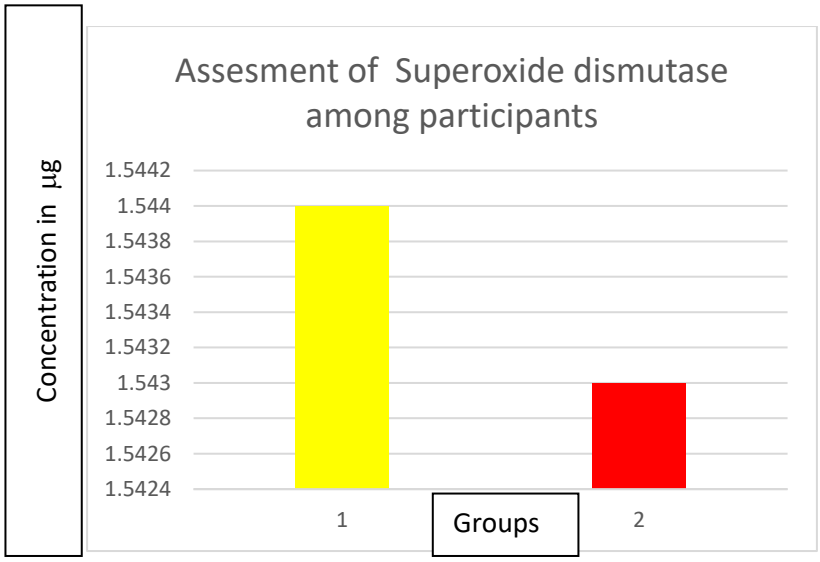


Figure 4: Comparison of Superoxide dismutase between two groups,1- (Female),group 2 (male)

4.2.2 Estimation of Glutathione peroxidase

Glutathione peroxidase is an antioxidant enzyme class with the capacity to scavenge free radicals. This in turn helps to prevent lipid peroxidation and maintain intracellular homeostasis as well as redox balance.

Group 2 (male) have higher level of change in the oxidative biomarker than the group 1(female) people (Figure 5).

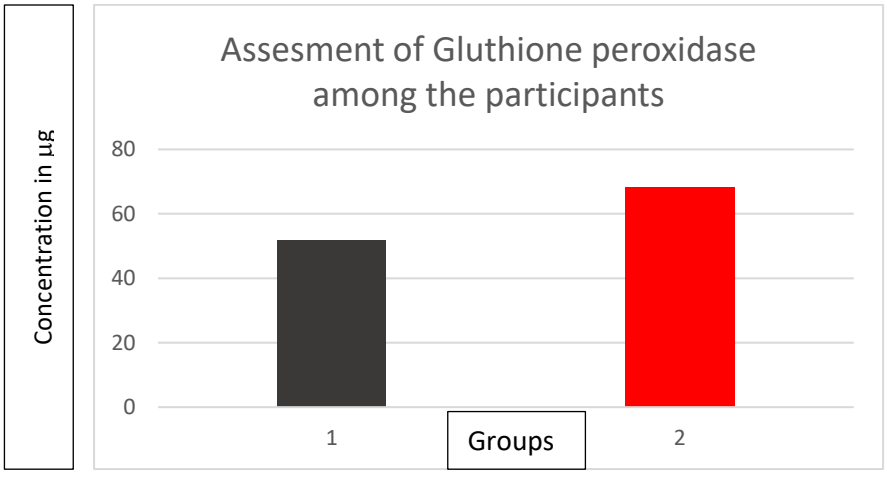


Figure 5: Comparison of Glutathione peroxidase between two groups, group 1 (female), group 2 (male)

4.2.3 Estimation of Reduced glutathione

Glutathione (GSH or reduced glutathione) is a tripeptide of gamma -Glutamyl cysteinyl glycine and the predominant intracellular organism including humans.

Reduced glutathione (GSH) is measured by its reaction with DTNB (5, 5-dithio- 2 -nitro benzoic acid) (Ellman's reaction) to give a compound that absorbs at 412nm.

From figure 6 we can identify that there is a huge difference in the level of oxidative biomarker. Both the groups have identified having increase in the level of the biomarker. But the level is higher group 1(Female) people than the group 2 (male) people

Reduced glutathione shows significance between the extensive usage of mobile phone. The significance value 0.045 is lesser than the probability value. So, there may be some relationship between the extensive mobile phone usage and increase in the level of reduced glutathione.

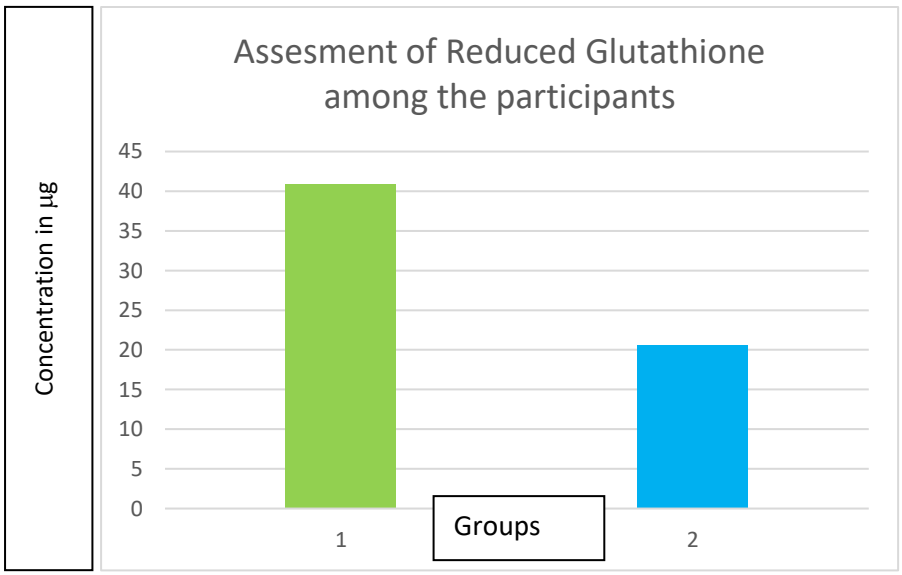


Figure 6: Comparison of Reduced Glutathione between two groups, group 1 (Female), group 2 (male)

4.2.4 Estimation of Vitamin A

Recent evidence has shown vitamin A, Carotenoids and pro vitamin A that carotenoids can be effective antioxidants for inhibiting the development of the heart disease. Vitamin A must be obtained from the diet: green and yellow vegetables, dairy products, fruits and organ meats are some of the richest sources.

The colour produced by vitamin A, its acetate or palmitate with TCA is proportional in intensity to its concentration, which is measured at 620 nm in a spectrophotometer.

From figure 7 we could spot that there is an increase in the level of oxidative biomarker in the group 1 people (Female) than group 2 participants(male).But it was in the normal range. Hence, Vitamin A (p=0.804), did not show any significance changes in both the groups.

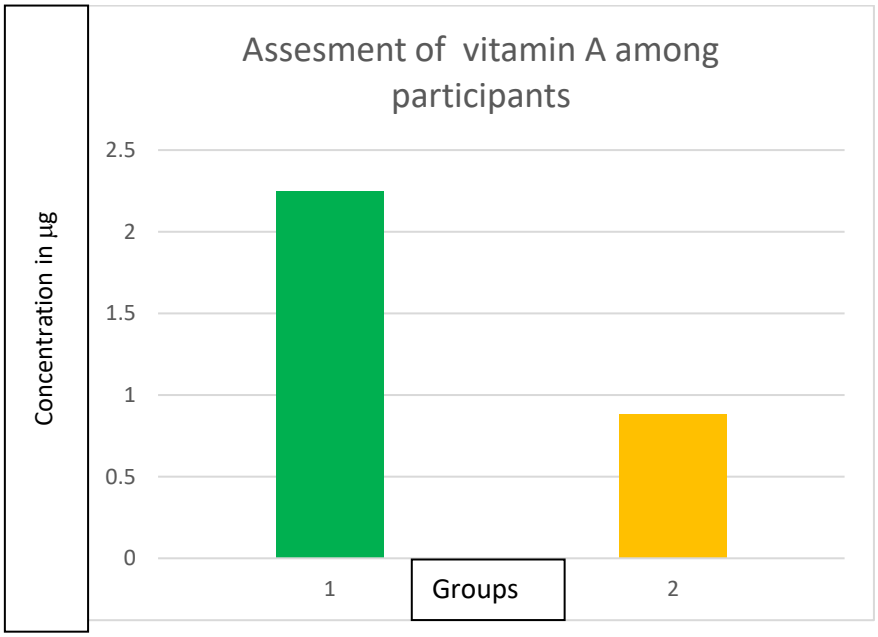


Figure 7: Comparison of Vitamin A between two groups, group 1(Female), group 2 (male)

4.2.5 Estimation of Vitamin E

Vitamin E is a fat-soluble vitamin with several forms, but alpha- tocopherol is the only one used by the human body. Its main role is to act as an antioxidant, scavenging loose electrons .so called “free radicals” that damage cells. The Estimation follows **(Quaife *et al*., 1949).**

Vitamin E can be estimated using Emmerie-Engel reaction which is based on the reduction of ferric to ferrous ions by tocopherols, which then forms a red colour with 2, 2’-

dipyridyl. Tocopherol and carotenes are first extracted with xylene and read at 460nm to measure carotenes. A correction is made for this after adding ferric chloride and read at 520nm.

From the study, Vitamin E did not significantly (p= 0.250) increased, when compared to group 1(Female) to Group 2(male).

Through the Vitamin E increased in group 1 compared to group 2, it is in the normal range.

This results revealed that the level of antioxidant doesn't increase on over usage of mobile phone.

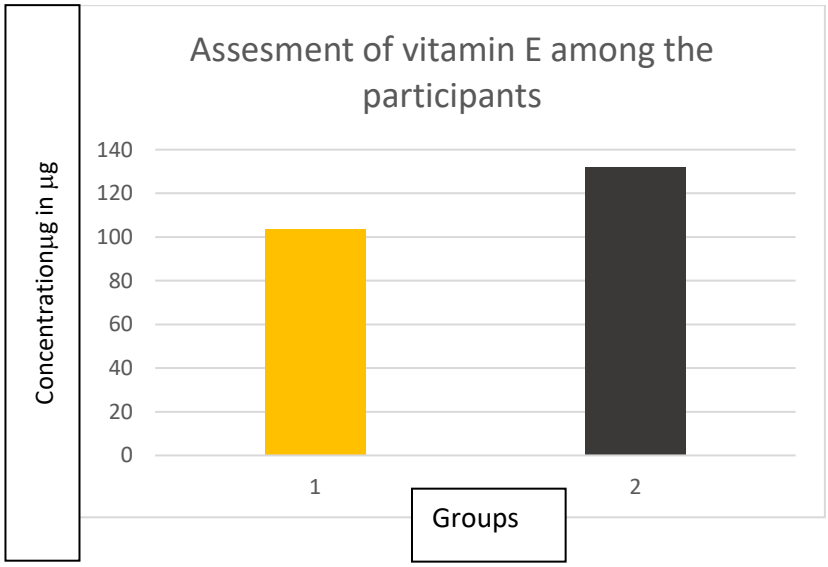


Figure 8: Comparison of Vitamin E between two groups ,group 1 (Female), group 2 (male)

4.2.6 Estimation of Vitamin C

Vitamin C is also vital to your body's healing process. Vitamin C is an antioxidant that helps protect your cells against the effects of free radicals – molecules produced when the body breaks down food or exposed to tobacco smoke and the radiation from the solar radiation, X rays or other source.

Ascorbic acid is oxidised by copper to form dehydro-ascorbic acid and di-ketoglutaric acid. These products are treated with 2,4 dinitrophenyl hydrazine to form the derivative of bis 2,4 dinitro phenyl hydrazine. This compound in strong sulphuric acid undergoes a rearrangement to form a product with an absorption band that is measured at 520 nm. The reaction is run in the presence of thiourea to provide a mildly reducing medium which helps to prevent interference from non-ascorbic acid chromogens

It is found that Vitamin C shows significance as it is 0.013 which is lesser than the P value $p<0.05$, which states that there is a change in the level of biomarker.

From figure 9 it is clear that there is an increase in the level of biomarker in group 1 people (Female) than in group 2 people(male). But in both the groups there is an increase in the level of vitamin C biomarker.

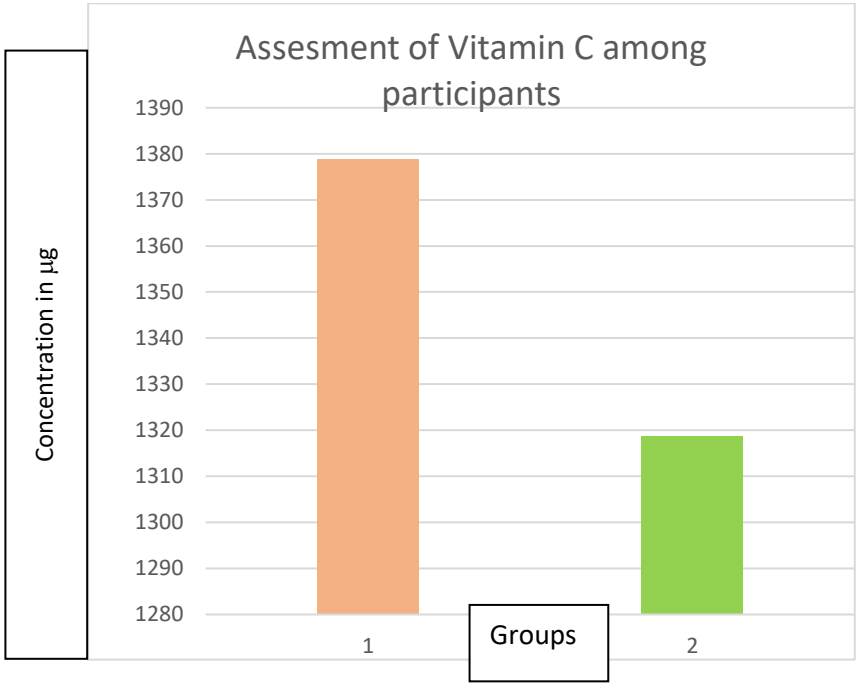


Figure 9: Comparison of Vitamin C between two groups, group 1 (Female), group 2 (male)

Among 90 participants 56 are male and 44 are female participants. All the participants are smart phones users. On the analysis of addiction behaviour Group 2 (Male) are higher compared to female. Both the Group of participants have the habit of checking mobile phones frequently, which indicates that people are very much fond of using mobile phone. According to the survey taken female participants have the indication of neck and wrist pain than male participants. Both the Group participants are using mobile phones more than 6 hours a day. Using mobile phone for the prolong duration leads to the eye defects such as myopia. Due to the radiation emitted from mobile phones. On basis of psychological analysis Female participants are affected more than male participants.

According to the finding of phase 1 they were grouped into Group 1(Female) and Group 2(Male), it is found that both groups undergo certain stress which resulted in increase in the

level of oxidative biomarkers. Enzymatic biomarkers like superoxide dismutase, glutathione peroxidase, reduced glutathione are found to be increased in both the groups. There is a significant increase in reduced glutathione higher in male than female was seen. Non-enzymatic biomarkers like Vitamin A, Vitamin C, Vitamin E also showed some level of increase in the biomarkers.

SUMMARY AND CONCLUSION

5

SUMMARY AND CONCLUSION

The use of mobile phones has become extensively popular in recent years. Despite the many benefits that mobile phones have as an opportunity, excessive use of them can cause various problems such as mobile addiction. Mobile phone addiction stimulate urge in people to use extensively for a longer period of time. It leads to many external and also internal problems like eye irritation, laziness, insomnia, tiredness, wrist pain, neck pain etc.

Now mobile phone has become an integral part of the body. All the people are now fond of mobile phones. Extensive use of mobile phone creates additional stress to the body. Oxidative stress leads to change in the level of oxidative biomarkers

Hence it is imperative to conduct the evaluation of oxidative biomarkers in relation with the self-reported symptoms among extensive usage of smartphone users on the basis of age which may help to examine age-related differences in requirements for mobile phones in the context of the transition from feature phones to smart phones

Objectives of the study

- To explore the impact of extensive usage of smartphone users through online questionnaire.
- To evaluate oxidative biomarkers in the blood sample of over-usage of smartphone users.
- To determine the levels of oxidative marker related to gender among extensive usage of smartphone users.

The study was conducted in two phases

PHASE I

Exploration of impact of extensive usage of mobile phone through online questionnaire

Online survey was conducted. A total number of 90 people participated in the survey. This survey includes the collection of information like demographic details of the participants, Analysis of habitual behaviour of the participants, awareness of mobile phone hazards by the participants and addiction behaviour of the participants on over usage of mobile phones. These questions carry the information about the personal details of the participants like age, gender,

height, weight, occupation, academic qualification, pain caused by the over usage of mobile phones, their addiction towards the mobile phones.

Salient findings

- Among 90 participants 56 are male and 44 are old female people. Both the groups use smart phones.
- On the analysis of addiction behaviour both the group are highly addicted towards the mobile phones
- Both the groups have the habit of checking mobile phones frequently which indicated that people are very much fond of using mobile phones.
- Group I (female) are reported wrist and neck pain on extensive usage of mobile phone than group 2(male).
- Both the groups (Group 1- female, Group 2- male) are using mobile phones more than 6 hours a day. Using mobile phone for a longer period on off light will affect the eyesight due to the blue light from the mobile phone.
- On addiction analysis Group 2 (male) are found to be more active with mobile phones all the time, which results in missing of social life, delay in work progress, laziness etc.

PHASE II

Evaluation of oxidative markers

According to the self-reported symptoms of participants who have complication on extensive usage of mobile phone, 20 participants were selected for the evaluation of oxidative markers. Questionnaire and informed concern were signed and 5 ml of blood sample was collected from the participants. Evaluation of Oxidative biomarkers like enzymatic includes Superoxide dismutase, Glutathione peroxidase reduced glutathione and non-enzymatic includes Vitamin A, Vitamin C, Vitamin E to know the level of oxidative biomarker were performed.

Salient findings

- According to the finding of phase I, they were grouped into two (Group I- female, Group II male), it is found that both the age groups undergo certain stress which resulted in increase in the level of oxidative biomarker

- Enzymatic biomarkers like Superoxide dismutase, glutathione peroxidase, reduced glutathione was found to be increased in both the group. There is a significant increase in oxidative biomarker level in bot the genders.
- Non enzymatic biomarkers like Vitamin A, Vitamin C, Vitamin also showed some level of increase in the biomarkers.
- Both groups are using mobile phones. Not only due to stress there will be changes found in the oxidative biomarkers of participants, there also may be hormonal different in gender, the changes happen.

Conclusions drawn from the findings of the present investigation

Pain and stress may cause increase in the level of oxidative biomarkers occurred due to extensive usage of mobile phones found from the self-reported symptoms from the participants.

Evaluation of biomarkers from participants resulted in increase in the level of oxidative biomarkers. Both the groups found to have increased level of biomarkers.

The study clearly suggested that an extensive usage of mobile phones may cause many changes in the metabolism that leads to the generation of ROS, which results in increase in the level of oxidative biomarker.

Scope for the future studies

- ✓ A study can be conducted on whether the increase in the level of oxidative biomarkers leads to any other problem like tumour, cancer, musculoskeletal problem or any other issues related to the pain
- ✓ Some more biomarkers can also be included to find the level of increase in the biomarkers caused due to the extensive usage of mobile phones

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APPENDIX

APPENDICES

Appendix I

Questionnaire Administered to the Study Volunteers

1. Name:
2. Age:
3. Gender:
4. Height:
5. Weight:
6. Blood group:
7. Blood pressure level:

   80-120/ Above 140/ Below 80
8. Academic qualification:

   10th or 12th/ diploma/ Undergraduate/ Postgraduate/ Doctorate/ None
9. Occupation:

   Student/ Working/ Nonworking
10. Accommodation:

    Home/ Hostel
11. Mobile phone user:

    Yes/no
12. Type of mobile phone usage:

    Smart phone/ Basic phone/ Both
13. Have undergone any neck pain on over usage of mobile phone:

    Yes/ No/ may be
14. Occurrence of neck pain:

    Rare/ frequent
15. Have undergone any major or minor accident or surgery:

    Yes/ No
16. If yes, specify
17. Total sleeping time:

Below 5 hours/ 5-8 hours/ above 8 hours

18. Sleeping Position:

Back/ Side/ Foetal position/ Stomach

19. Number of years of mobile phone usage:

1-5 years/ 6-10 years/ 11-15 years/ above 15 years

20. Duration of mobile phone usage per day:

Less than 1 hour/ 1-2 hrs/ 3-6 hrs/ More than 6 hrs

21. Frequency of mobile phone checking:

Frequent/ Rare

22. Checking of mobile phone in between sleep:

Yes/ No/ Rare

23. Felt any discomfort while using mobile phone:

Yes/ No

24. Felt any ear discomfort while using mobile phone:

Yes/ No

25. Place of mobile phone keeping:

In the bag/ Around your pelvic area/ Around your neck

26. Most frequently used app:

Entertainment/ Photography/ Communication/ Education/ Game/ social media/ Reading books/ Job related/ Business/ Others

27. Have you aware of EMR:

Yes/ No

28. Having any pain on wrist and hand because of smart phone use:

Yes/ No

29. Any medication for neck pain:

own medication/ Doctor prescribed / none

30. Preference of medication:

Tablets/ Ointment/ Spray/ Physical therapy/ None

31. Any other complication on over usage of mobile phone along with neck pain?

32. Posture of mobile phone usage:

0 degree/15 degree/30 degree/ 45 degree/ 60 degrees

33. Finding too much of time are engaged with mobile phone:

Yes/ No

34. Missing planned work because of mobile phone use:

Yes/ No

35. Using of mobile causing any mental or psychological disturbance:

Yes/ No

36. Feeling of missing normal social life on usage of mobile phone:

Yes/ No

Informed consent

Informed consent form for study volunteers who are participating in the research on evaluation of oxidative biomarkers on extensive usage of mobile phones

The title of the research project is "Evaluation of oxidative biomarkers in relation with the self-reported symptoms among over-usage of smartphone users on the basis of gender.

Principal Investigator : **Pavithra.S**

Organisation : **Department of Biochemistry, Biotechnology and Bioinformatics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore- 641 043, Tamil Nadu, India.**

Name of the proposal : **Evaluation of oxidative biomarkers in relation with the self-reported symptoms among over usage of smartphone users on the basis of gender.**

The informed consent form has two parts:

1. Information sheet (to share information about the research with you)
2. Certification of consent (for signature if you agree to take part)

You will be given a copy of the full Informed consent form

Part I: Information sheet

Introduction

I am S.Pavithra, Student, Department of Biochemistry, Biotechnology and Bioinformatics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore. I am carrying out a study on the topic of Evaluation of Oxidative Biomarkers in relation with the self-reported symptoms among over usage of smart phone users on the basis of gender as part of my research project. Before you decide, you can talk to anyone you feel

comfortable with about the research. There may be some words that you do not understand. Please as me to explain. If you have any questions later, you can ask the staff or me.

Purpose of the research

Mobile phone over-usage leads to clinical complications in our body, in such condition where the body produce ROS response which in turn increase the oxidative biomarker in our body. This study is being done to associate the level of oxidative biomarkers from the blood sample collected from mobile phone over users. Also, to find the specific oxidative marks which expressed in higher level and its role in creation of stress.

Type of Intervention

This research will involve in collection of blood samples to determine the change in the oxidative biomarkers on extensive usage of mobile phone.

Selection of the participants

We are inviting all adults in the age group of 18-45 who use mobile phones in their day today life and undergone any physiological stress like neck pain, wrist discomfort in and around Coimbatore, to participate in the evaluation of oxidative biomarkers.

1. Do you know why we asking to take part in this study?
2. Do you know what the study about?

Voluntary participation

Your participation in this research is entirely voluntary. It is your choice whether to participate or not. You may change your mind later and stop participating even if you agreed earlier.

1. Do you know that you do not have to take part in this research study, if you do not wish to?
2. Do you have any questions?

Procedure and protocol

A. Unfamiliar procedures

We will take blood from your arm using syringe and needle. We will take about 5ml of blood. At the end of the research, in 1 year, any leftover blood samples will be destroyed.

B. Description of the process

1. At first, we will ask you to answer the questions we have and fill up a questionnaire, which asks for personal and personal details.

2. Then, about 5.0 ml of blood, equal to about a teaspoon, will be taken from your arm with a syringe. This blood will be tested for the identification of change in the oxidative biomarker

a. We will also ask you a few questions about your general health and measure how tall you are and how much your weight

Duration

The research takes place over a period of 6 months.

1. Can you tell me if you remember, the number of times that we are asking you to come to the hospital to complete the treatment?
2. The research projects?
3. How much blood will be taken from your veins, using a syringe and needles?
4. Do you have any other questions?
5. Do you want me to go through the procedures again?

Side Effects

There are no potential side effects dur to this study

Risks

There is no potential risk in participating in this study

Benefits

There may not be any benefits but it is likely to help us to find change in oxidative biomarkers on over usage of smart phone users. There may not be any benefits to the society at this stage of research, but in future we may be able to tell whether on extensive usage of mobile phone causes any change in the level of oxidative biomarker and to bring awareness to society.

Reimbursements

You will not be given money or gifts to take part in this research.

1. Can you tell me if you have understood correctly the benefits that you will have if you take part in the study?

2. Do you know if the study will pay for your travel costs?
3. Do you have any other questions?

Confidentiality

With this research, something out of the ordinary is being done in your community. It is possible that if others in the community are aware that you are participating, they may ask you questions. We will be sharing the identity of those participating in the research. The information that we collected from this research project will be kept confidential. The information about you that will be collected during the research will be put away and no one but the researchers will be able to see it. Any information will have a number on it instead of your name. Only the researchers will know what the number is and we lock that information with lock and key. It will not be shared with or given to anyone.

1. Did you understand the procedures that we will be using to make sure that any information that we as researchers collect about you will remain confidential?
2. Did you have any question about this?

Sharing the results

We plan to give you the result of level of antioxidants in your blood.

Right to refuse or withdraw

You do not have to take part in this research if you do not wish to do so. You may also stop participating in the research at any time you choose. It is your choice and all of your rights will still be respected.

Whom to contact

If you have any questions, you ask them now or later, even after the study has started. If you wish to ask question later, you may contact any of the following

S.Pavithra, Student, Post Graduate Student, Department of Biochemistry, Biotechnology and Bioinformatics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore- 641043, Ph:7339589021Email: pavithrasuvithra@gmail.com

This proposal has been reviewed and approved by Institutional Human Ethics Committee, (AUW/IHEC/BC-21-22/XPD-02) Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore- 641043, which is a committee whose task is to

make sure that research participants are protected from harm. If you wish to find more about the Institutional Review Board, contact,

Dr. S. Uma Mageshwari, Member Secretary, Institutional Human Ethics Committee, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore-641043

Part II: Certificate of Consent

The above information regarding the study, has been read by me/ read to me, and has been explained to me by the investigator(s). Having understood the same, I hereby give my consent to them to interview me, and collect biological sample 5ml Blood from me. I am affixing my signature / left thumb impression to indicate my consent and willingness to participate in this study (i.e., willingly abide by the project requirements)

Signature / Left thumb impression of the Study Volunteer / Legal Representative:

Signature of the Interviewer with date: _____

Signature of the Witness with name: _____

Statement by the Researcher/Person taking Consent

I have accurately read out the information sheet to the potential participant and to the best of my ability made sure that the participant understands that the following will be done:

1. Collection of 5 ml of blood sample

I confirm that the participant was given an opportunity to ask questions about the study and all the questions asked by the participants have been answered correctly and to the best of my ability. I confirm that the individual has been coerced into given consent and the consent has been freely and voluntarily.

A copy of this ICF been provided to the participant

Name of the Researcher/ Person taking the consent: _____

Signature of Researcher/ Person taking the consent: _____

Date: _____

Appendix-2

Estimation of Superoxide dismutase activity

Spectrophotometry method

(Beauchamp and Fridovich, 1971)

Principle

Superoxide dismutase uses the photochemical reduction of riboflavin as oxygen generating systems and catalyses the inhibition of Nitro Blue Tetrozolium (NBT) reduction, the extent of which can be assayed spectrophotometrically at 600nm.

Reagents

1. 250mM Potassium phosphate buffer (pH 7.8)
2. 100mM Methionine
3. 10mM Riboflavin
4. 750µM Nitro Blue Tetrazolium (NBT) salt
5. 5mM EDTA

Procedure

Mixed a 3ml reaction cocktail containing: 50mM potassium phosphate buffer, 13mM methionine, 2µM riboflavin, 0.1mM EDTA and 75µl NBT. To the test 0.1 ml of plasma was added. The reagents were added in dark. Reduced NBT was measured spectrophotometrically at 560nm after exposure to light for 15 minutes. The 50% inhibition of the reaction between riboflavin and NBT in the presence of methionine is taken as 1 unit of SOD activity. The enzyme activity was expressed as units/ml of sample.

Pipetted into tubes marked	Blank	Standard	Test
Reagents			
Methionine(ml)	2.5	2.5	2.5
Riboflavin(ml)	0.3	0.3	0.3
NBT (ml)		0.1	0.1
0.4M Phosphate buffer (ml)	0.2	0.1	
Plasma (ml)			0.1

Appendix-3

Estimation of Glutathione peroxidase activity

Spectrophotometry method

(Rotruck *et al*., 1973)

Reagents:

1. 0.4M Sodium phosphate buffer (pH 7.0)
2. 10mM Sodium azide
3. 4mM Reduced glutathione
4. 2.5mM H_2O_2
5. 10% Trichloro acetic acid
6. Phosphate solution: 0.3mM Disodium hydrogen phosphate
7. DTNB reagent: 40 mg of 5, 5 dithiobis (2-nitro benzoic acid) / 100ml of 1% Sodium citrate
8. Reduced glutathione standard: 20 mg percent solution.

Procedure:

0.4 ml of buffer, 0.1 ml sodium azide, 0.2 ml reduced glutathione, 0.1 ml of plasma, 0.1 ml hydrogen peroxide and water were taken to a final incubation volume of 2.0 ml. The

test tubes were incubated at 30^0C for 10 minutes. The reaction was terminated by the addition of 0.5 ml of trichloroacetic acid. To determine the residual GSH content, 1 ml supernatant was removed by centrifugation and added 3ml of disodium hydrogen phosphate and 1ml of DTNB reagent. The colour was read at 412 nm. A blank was prepared with only disodium hydrogen phosphate and 1 ml of DTNB reagent. Suitable aliquots of the standard were taken and treated similarly. The activity was expressed as µg of glutathione consumed/minute/ml of sample.

	Conc	Buffer(ml)	Sodium azide (ml)	Reduced Glutathione (ml)	Hydrogen peroxide (ml)	H2O (ml)	Incubate at 37℃ for 10 mins	TCA (ml)	Centrifuged for 10mins	Supernatant (ml)	Disodium hydrogen phosphate (ml)	DTNB (ml)	Optical density 412 nm
Blank										1			
Standard S1	0.1	0.4	0.1	0.2	0.1	1.1		0.5		1	3	1	
S2	0.2	0.4	0.1	0.2	0.1	1		0.5		1	3	1	
S3	0.3	0.4	0.1	0.2	0.1	0.9		0.5		1	3	1	
S4	0.4	0.4	0.1	0.2	0.1	0.8		0.5		1	3	1	
S5	0.5	0.4	0.1	0.2	0.1	0.7		0.5		1	3	1	
Test	0.1	0.4	0.1	0.2	0.1	1.1		0.5		1	3	1	

Appendix-4

Estimation of Reduced glutathione

Spectrophotometry method

(Moron *et al*., 1979)

Principle

Reduced glutathione (GSH) is measured by its reaction with DTNB (5, 5-dithio- 2 -nitro benzoic acid) (Ellman's reaction) to give a compound that absorbs at 412nm.

Reagents

1. DTNB solution: 0.6mM 5, 5-dithio- 2 -nitro benzoic acid in 0.2M phosphate buffer.

2. 5% Trichloroacetic acid

3. 0.2M Sodium phosphate buffer (pH 8.0)

4. Glutathione standard:10mg Reduced glutathione in 100ml of 5% TCA

Procedure

0.1 ml of plasma and 0.2 ml of trichloroacetic acid were added and centrifuged for 15 minutes at 1500 rpm. 2.0 ml of dithionitrobenzoic acid (DTNB) was added to 0.1 ml of the supernatant and the total volume made up to 3.0 ml with 0.2M phosphate buffer. The colour developed was read at 412 nm in a UV visible spectrophotometer.

	Conc	5%TCA (ml)	Centrifuge 15mins At 1500 rpm	Supernatant (ml)	Di thiobenzoic Acid (ml)	0.2M Phosphate buffer	Optical density(412 nm)
Blank							
Standard S1	0.2	0.2		0.1		0.9	
S2	0.4	0.2		0.1		0.9	
S3	0.6	0.2		0.1		0.9	
S4	0.8	0.2		0.1		0.9	
S5	1.0	0.2		0.1		0.9	
Test	0.1	0.2		0.1		0.9	

Appendix-5

Estimation of Vitamin A

Spectrophotometry method

(Bayfield and Cole, 1980)

Principle

The colour produced by vitamin A, its acetate or palmitate with TCA is proportional in intensity to its concentration, which is measured at 620 nm in a spectrophotometer.

Reagents

All reagents were prepared fresh. Exposure of samples and reagents to light was avoided at all times.

1. Saturated Trichloro acetic acid (TCA) in chloroform: 15 g clear TCA crystals were dissolved in 25 ml of alcohol- free chloroform, stored in dark.
2. Standard vitamin A: 1.5 mg vitamin A palmitate / 10 ml of chloroform.
3. Petroleum ether (40-60^{o}C)
4. 95% ethanol

Vitamin A extraction

Equal volume of ethanol was added to 0.1 ml plasma and shaken with 0.3 ml petroleum ether for 3minutes. This was centrifuged to separate the layers. Petroleum ether layer was pipetted, evaporated to dryness, dissolved in 0.5ml alcohol- free chloroform and was taken as test.

Procedure

Aliquots of the standard were pipetted out into a series of clean, dry test tubes and 0.2 ml test was taken in another test tube. The volumes in all the tubes were made up to 1.0 ml with chloroform. 2 ml of TCA reagent was added and rapidly mixed with the contents of the tube. The absorbance was recorded immediately at 620 nm in a spectrophotometer. Constructed a standard graph and read off the concentration in the sample.

	Conc(ml)	Chloroform(ml)	TCA (ml)	Rapidly mixed With Content immediately	Optical density (620nm)
Blank					
Standard (s1)	0.2	0.8	2		
S2	0.4	0.6	2		
S3	0.6	0.4	2		
S4	0.8	0.2	2		
S5	1.0	0	2		

Test	0.2	0.8	2		

Appendix-6

Estimation of Vitamin E

Spectrophotometry method

(Quaife *et al*., 1949)

Principle

Vitamin E can be estimated using Emmerie-Engel reaction which is based on the reduction of ferric to ferrous ions by tocopherols, which then forms a red colour with 2, 2'-dipyridyl. Tocopherol and carotenes are first extracted with xylene and read at 460nm to measure carotenes. A correction is made for this after adding ferric chloride and read at 520nm.

Reagents

1. Absolute alcohol
2. Xylene
3. 2, 2'- dipyridyl: 1.2 g in 1 litre of N- propanol.
4. Ferric chloride solution: 1.2 g of $FeCl_3$.$6H_2O$ in 1 litre of ethanol and kept in a brown bottle.
5. Standard solution: Dissolved 100mg of tocopherol acetate in 1liter absolute alcohol.

Procedure

Into 3 stoppered centrifuge tubes (test, standard and blank) pipetted out 0.3 ml of plasma, 0.3 ml of standard and 0.3 ml of water respectively. Added 1.0 ml ethanol, 1.0 ml xylene to all the test tubes, stoppered, mixed well and centrifuged. Transferred 1.0 ml of xylene layer into another stoppered tube, taking care not to include ethanol layer. Added 1.0 ml of 2, 2'- dipyridyl reagent to each tube, stoppered and mixed. The test and standard were read against the blank at 460nm. Then beginning with the blank, in turn, added 0.33 ml of ferric chloride solution. After 15 minutes the test and standard were read against the blank at 520 nm.

		Ethanol	Xylene	Centrifuged for 10mins To separate the xylene layer	Supernatant(ml)	2,2-Dipyridyl (ml)	Optical density (460nm)	Chloride(ml)	Optical density(520nm)
Blank	0.3	1	1		1	0.1		0.33	
Standard	0.3	1	1		1	0.1		0.33	
Test	0.3	1	1		1	0.1		0.33	

Appendix – 7

Estimation of Vitamin C

Spectrophotometry method

(Omaye *et al*., 1979)

Principle

Ascorbic acid is oxidised by copper to form dehydroascorbic acid and Di ketoglutaric acid. These products are treated with 2,4 dinitrophenyl hydrazine to form the derivative of bis 2,4 dinitro phenyl hydrazine. This compound in strong sulphuric acid undergoes a rearrangement to form a product with an absorption band that is measured at 520 nm. The reaction is run in the presence of thiourea to provide a mildly reducing medium which helps to prevent interference from non-ascorbic acid chromogens.

Reagents

1. 5% TCA
2. 65% Sulphuric acid
3. DTCS reagent: 3 g of 2,4 DNPH, 0.4 g thiourea and 0.05 copper sulphate dissolved in 9 N sulphuric acid and made up to 100 ml.

4 Standard: Ascorbic acid in the range of 4-20 µg/ml was prepared in 5% oxalic acid.

Procedure

0.1 ml of plasma was precipitated with 5% ice-cold TCA and centrifuged for 20 min. 0.1 ml of the supernatant was mixed with 0.02 ml of DTCS reagent and incubated for 3 hours

at 37°C. Then 0.15 ml of ice-cold 65% sulphuric acid was added. Mixed well and the solutions were allowed to stand at room temperature for an additional 30 min. Absorbance was determined at 520 nm. The results were expressed as mg/dl.

	Conc (ml)	Oxalic acid (ml)	DTCS (ml)		65% H2SO4 (ml)	Mixed well & Additional 30 mins in room temperature	Optical density (520nm)
Blank				Incubate At 37℃ For 3 hours			
Standard S1	0.2	0.8	0.02		0.15		
S2	0.4	0.6	0.02		0.15		
S3	0.6	0.4	0.02		0.15		
S4	0.8	0.2	0.02		0.15		
S5	1.0	0	0.02		0.15		
Test	0.1	0.9	0.02		0.15		

ANNEXURE

ANNEXURE

Annexure I

Online questionnaire

Questions Responses 63 Settings

Responses cannot be edited

Analysis of complication on over usage of mobile phone

A survey of results on mobile phone over usage based on gender.

* Required

Email *

dheeshamanigandan@gmail.com

Name (Capital) *

DHEESHA

Age *

- (•) 18- 30
- ( ) 30- 45

Questions Responses 63 Settings

Gender *

- ( ) Male
- (•) Female

Height *

164 cm

Weight *

47 kg

Blood group *

O+ve

Questions Responses 63 Settings

Occupation *

- (•) Student
- ( ) Working
- ( ) Non working
- ( ) Other:

Accommodation *

- (•) Home
- ( ) Hostel

Mobile phone users *

- (•) Yes
- ( ) No

Questions Responses 63 Settings

Type of mobile phone usage *

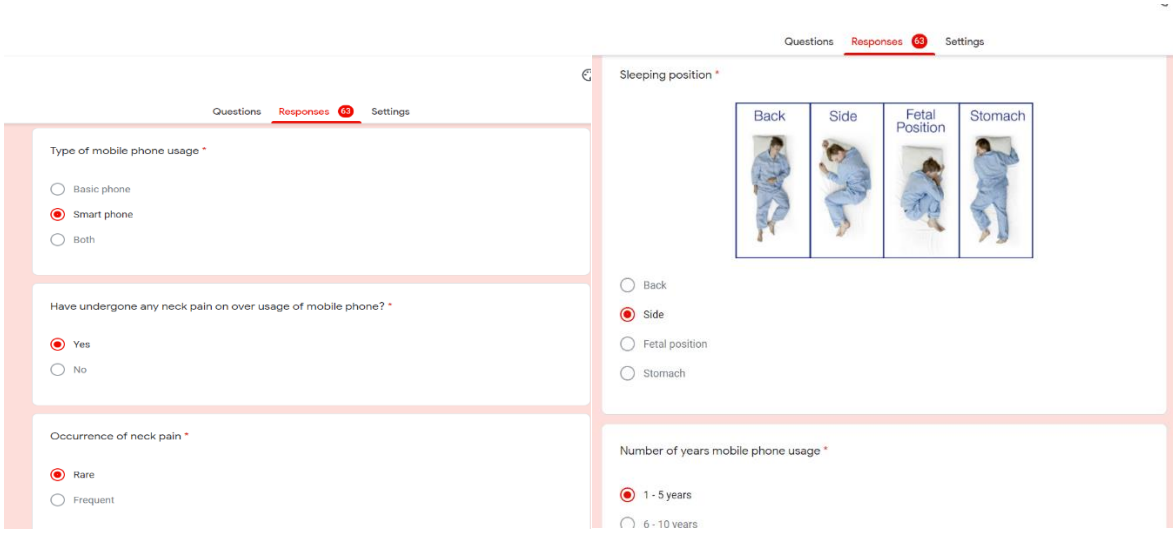
- ( ) Basic phone
- (•) Smart phone
- ( ) Both

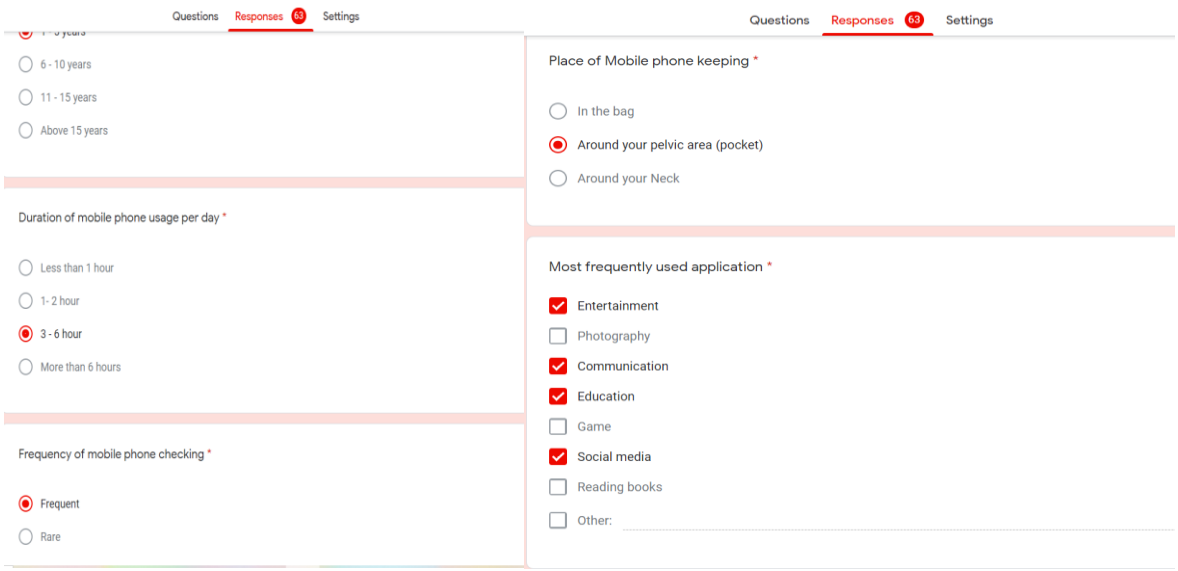
Have undergone any neck pain on over usage of mobile phone? *

- (•) Yes
- ( ) No

Occurrence of neck pain *

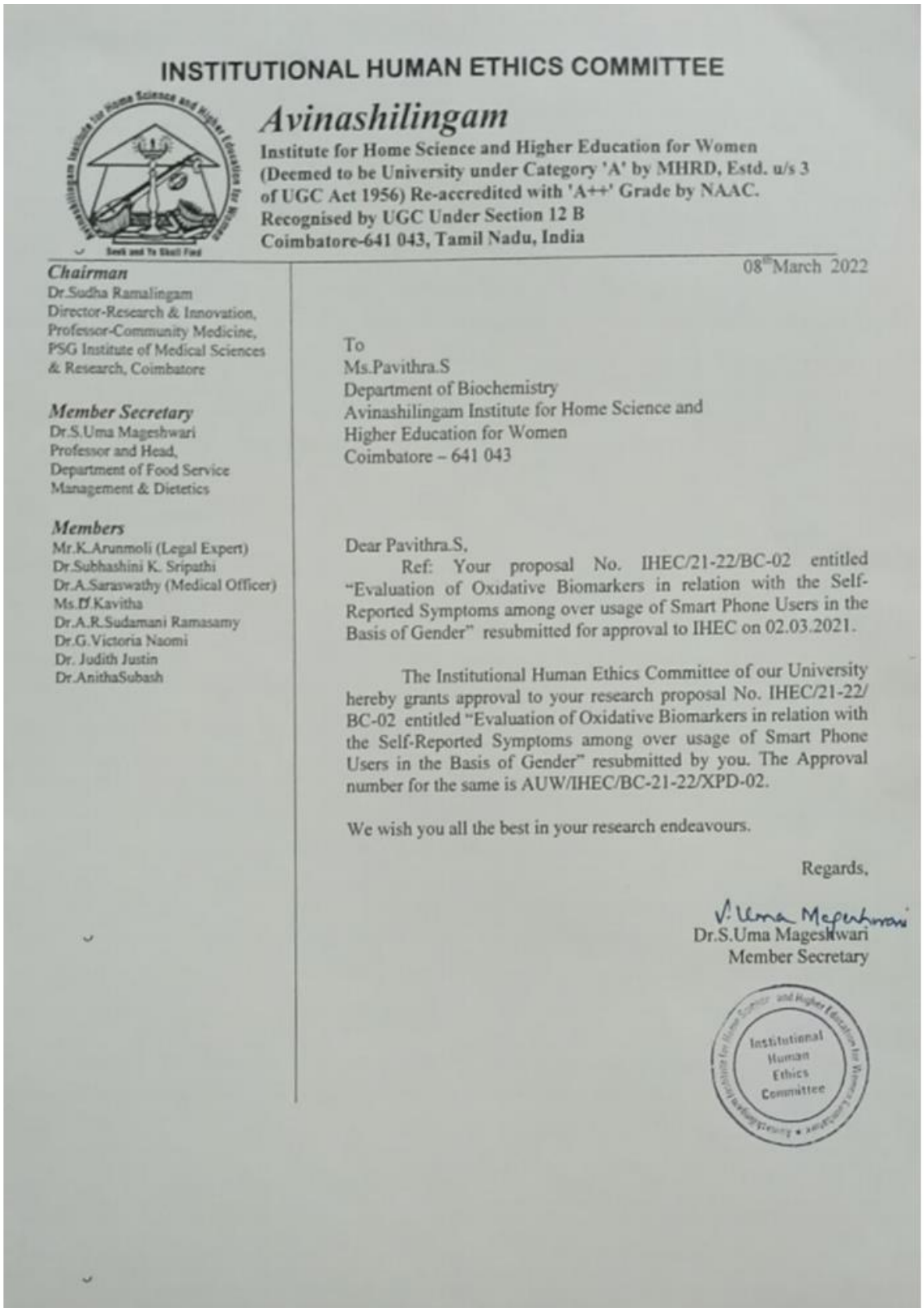
- (•) Rare
- ( ) Frequent


Questions
Responses 63
Settings
Type of mobile phone usage *
Basic phone
Smart phone
Both
Have undergone any neck pain on over usage of mobile phone? *
Yes
No
Occurrence of neck pain *
Rare
Frequent
Questions
Responses 63
Settings
Sleeping position *
Back
Side
Fetal Position
Stomach
Back
Side
Fetal position
Stomach
Number of years mobile phone usage *
1 - 5 years
6 - 10 years


Questions
Responses 63
Settings
6 - 10 years
11 - 15 years
Above 15 years
Duration of mobile phone usage per day *
Less than 1 hour
1- 2 hour
3 - 6 hour
More than 6 hours
Frequency of mobile phone checking *
Frequent
Rare
Questions
Responses 63
Settings
Place of Mobile phone keeping *
In the bag
Around your pelvic area (pocket)
Around your Neck
Most frequently used application *
Entertainment
Photography
Communication
Education
Game
Social media
Reading books
Other:

Annexure 2

Ethical approval for all studies involving Human participants



INSTITUTIONAL HUMAN ETHICS COMMITTEE

Avinashilingam

Institute for Home Science and Higher Education for Women
(Deemed to be University under Category 'A' by MHRD, Estd. u/s 3 of UGC Act 1956) Re-accredited with 'A++' Grade by NAAC.
Recognised by UGC Under Section 12 B
Coimbatore-641 043, Tamil Nadu, India

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Dr.Sudha Ramalingam
Director-Research & Innovation,
Professor-Community Medicine,
PSG Institute of Medical Sciences
& Research, Coimbatore

Member Secretary
Dr.S.Uma Mageshwari
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Department of Food Service
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Dr.A.Saraswathy (Medical Officer)
Ms.D.Kavitha
Dr.A.R.Sudamani Ramasamy
Dr.G.Victoria Naomi
Dr. Judith Justin
Dr.AnithaSubash

08th March 2022

To
Ms.Pavithra.S
Department of Biochemistry
Avinashilingam Institute for Home Science and
Higher Education for Women
Coimbatore – 641 043

Dear Pavithra.S,

Ref: Your proposal No. IHEC/21-22/BC-02 entitled "Evaluation of Oxidative Biomarkers in relation with the Self-Reported Symptoms among over usage of Smart Phone Users in the Basis of Gender" resubmitted for approval to IHEC on 02.03.2021.

The Institutional Human Ethics Committee of our University hereby grants approval to your research proposal No. IHEC/21-22/BC-02 entitled "Evaluation of Oxidative Biomarkers in relation with the Self-Reported Symptoms among over usage of Smart Phone Users in the Basis of Gender" resubmitted by you. The Approval number for the same is AUW/IHEC/BC-21-22/XPD-02.

We wish you all the best in your research endeavours.

Regards,

Dr.S.Uma Mageshwari
Member Secretary

Institutional Human Ethics Committee

Annexure 3

Paper presented on National conference sponsored by SERB and CSIR

ABSTRACT BOOK

NATIONAL CONFERENCE ON

"Recent Advances in Life Sciences towards Health Care"

(RALSH-2022)

Sponsored by

SERB & CSIR

22nd & 23rd April, 2022

Organized by

SCHOOL OF LIFE SCIENCES (Ooty Campus)

JSS ACADEMY OF HIGHER EDUCATION & RESEARCH, MYSURU

(Deemed to be University)

Accredited 'A+' Grade by NAAC

OP-30

OVERUSAGE OF MOBILE PHONE AND THEIR COMPLICATIONS BASED ON` GENDER- A PRILIMINARY STUDY

Pavithra S[1] and Shalini K.V[2]

[1]Student, II M.Sc Biochemistry, Department of Biochemistry, Biotechnology and Bioinformatics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore
[2] Assistant Professor, Department of Biochemistry, Biotechnology and Bioinformatics, Avinashilingam Institute for Home Science and Higher Education for Women, Coimbatore

corresponding author: mail id: pavithrasuvithra@gmail.com

Mobile phones are well founded devices for communication and entertainment. However, their utilization for prolonged period in flexed neck position is linked to neck and shoulder pain. Later days, it leads to huge physiological and physical health issues. This study aimed to relate the over usage of mobile phone with the help of self- reported symptoms of participants and its associated complications.This online study conducted in form of survey between November 2021-December 2021. Questionnaire was prepared and online survey method was carried out to collect the data including demographic details, habituation, previous awareness on mobile phone hazards and addiction behaviour of the participants. Statistical analysis was performed using SPSS 25 to analyse the complication of over usage of mobile phone among participants based on the gender and the results were summarized. According to the analysis, main complication occurs while using mobile for long span of time is" Neck pain "based on the posture of mobile phone used for purpose. The posture can be categorized in form of Degree such as 0-degree,15-degree, 30-degree,45-degree,60 degree. The fact is over-/long time usage of mobile phone may cause behavioural alteration and induce addictive behaviour. On comparison of genders female are more prone to many complications caused by mobile phone usage than male.

Key points: Questionnaire, demographic details, statistical analysis