



CHANGES IN BLOOD PARAMETERS OF HUMAN ASSOCIATED WITH EXCESSIVE USAGE OF MOBILE PHONES

Pathology

**Dr Chandra
Sekhar
Mohapatra***

M.D. Associate Professor Department of Pathology, Sri Ram Chandra Bhanja Medical College and Hospital, Cuttack, Odisha, India *Corresponding Author

**Sambhab
Mohapatra**

M.S.

ABSTRACT

Background: The world has rapidly changed over the past few decades with the advent of mobile phones. Almost seven billion mobile phones are now used worldwide, of which over five billion are in developing countries. Mobile phones emit low levels of radiofrequency energy (RF). The widespread usage of mobile phones in recent years has raised concern for potential dangers and subsequent research activities. Most of the studies on mobile phone radiation and its biological effects are short-term exposure studies with varied results. No formal studies examining the changes in blood parameters of human associated with mobile phones have been found in the medical literature to date. Study of changes in blood parameters due to excessive use of mobile phones was rare and is first of its kind in our community.

Objectives: The present study was conducted with an objective to investigate whether excessive use of mobile phones are associated with any abnormal changes in blood parameters of users and comparing the data with those of non-users of mobile phones.

Methods: The study was based on survey questionnaire consisting of four questions which adequately covered the information related to the topic basing on which we divided the population surveyed into four groups from excessive users to non-users of mobile phones. The heart rate and blood pressure were measured with Digital Blood Pressure Monitor, Model CH-432B, Citizen, Japan and complete blood count (CBC) were performed using an automated coulter counter 'Sysmax machine' in all participants. The data were accumulated and analysed.

Result: From the study it was found that 22.6% people were using mobile phones more than sixty minutes in 24 hours time (excessive users), 67.4% use daily but less than 60 minutes time, 4.4% use mobile only occasionally not daily and 5.6% of people do not have mobile phones, do not know their use (non-users). It was found that tachycardia and hypertension both were common in excessive users of mobile phones in comparison to non-users. Moreover among the excessive users the abnormal blood parameters observed were decrease Hb%, decrease TRBC, decrease TPC and increased red cell distribution width (RDW).

Conclusion: In conclusion we found tachycardia, hypertension, anaemia, thrombocytopenia and increased RDW were commonly associated with individuals who use mobile phones excessively.

KEYWORDS

Mobile phones, Electromagnetic radiation, Tachycardia, Hypertension, CBC, Blood, parameters

INTRODUCTION:

Communication technology has developed with leaps and bound since last few years and mobile phones are one of the popular and fastest growing technological advancements. It has become necessary in our modern life. Now a days mobile phones have become a part and parcel of our everyday life not only in India but also in all other countries. The world has rapidly changed over the past few decades with the advent of mobile phones. About seven billion mobile phones are now used worldwide, of which over five billion are in developing countries [1,2]. There are dissimilar types of mobile phone devices which are utilized for communicating with each other such as cell phones, wireless router, tablet PC, cell telephone tower, wireless hand free, bluetooth device, audio player, laptop connected to the wireless router (Wi-Fi). The mobile radiations utilize the frequency range from 3 kHz to 300 GHz, which consists of different wireless devices and give off harmful radiations which can contribute too many disorders and diseases [3,4,5].

The widespread usage of mobile phones from simple talking to complex transactions via internet in recent years has raised concern for potential health hazards and hence need of research activities relating to it [5,6,7]. No formal studies examining the changes in blood parameters of human associated with mobile phones have been found in the medical literature to date. The present study was conducted with an objective to investigate whether excessive use of mobile phones are associated with any abnormal changes in blood parameters of users and comparing the data with those of non-users of mobile phones.

New research, reported in the journal of the Weston A. Price Foundation, Wise Traditions, January 16, 2015, shows the act of carrying a cell phone (mobile smart phone) in a receptive mode in a backpack is sufficient to create disturbing changes in a person's blood, without the cell phone being used. Therefore this study of its kind to observe changes in blood parameters due to excessive use of mobile phone carries lot of concern, interest and significance.

MATERIALS AND METHODS:

The study was conducted from October 2016 to January 2017 in SCB

Medical College, Cuttack, Odisha and based on survey questionnaire and the data was obtained from randomly selected five hundred persons consisting of both genders with age group 18 to 80 years with their written consent to be recruited in to the study. Below 18 years age not included in this series on account of consent issue. Any one with known disease also excluded from the study. The survey questionnaire

consisting of four questions :

- (1) Do you use mobile phones? if yes, time of use in a day? Less than 60 minutes or more than that?
- (2) Do you suffer from any disease including blood disease and hypertension?
- (3) Do you want to check your pulse/heart rate and blood pressure?
- (4) Are you willing to participate in the study by allowing complete blood count (CBC) test of your blood?

The questionnaire were distributed among the individuals participating in the study and their response were recorded. According to their response of the survey questionnaire we divided the study group into four groups as follows (Table-1): Group A-Individuals with excessive use of mobile phones (using mobiles >60 minutes/24 hours) Group B- Individuals with daily use of mobiles but less than 60 minutes/24 hour Group C-Those people who use mobile phones only sometimes occasionally, do not use daily. Group D- Individuals who do not have mobile phones, do not know the use, never used it (non-users). Pulse and blood pressure was recorded with Digital Blood Pressure Monitor, Model CH-432B, Citizen Group Healthcare Products Division, Made in Japan, and a Manual Sphygmomanometre Model no 1002, Made in Germany and with a Littman Classic III™ 27" Monitoring Stethoscope, Made in USA. All the recruited individuals were investigated and complete blood count (CBC) were performed using an automated coulter counter ACT5 Diff Haematology Analyzer 'XN-350 Sysmax machine' as per company guideline following SOPs within 1 hour of sample collection [10,13,16]. Everyday quality control checks were performed and recorded; commercial controls were used in accordance with manufacturer's recommendations. The

machine provided data on WBCs, RBCs, haemoglobin level, platelet counts, Mean platelet volume, red cell distribution width (RDW) and five part differentials and histograms.

Haematological parameters consisting of red blood cells, white blood cells, platelets, red cell distribution width, mean platelet volume and haemoglobin were measured and recorded. Out of 113 of Group-A individuals we took 100 number of individual's test reports which were without any ambiguity (Cases of excessive users) and test reports of all 28 number of Group-D (Non users) as controls for comparison. All the test results of cases and controls were compiled and data were analysed and a P value of <0.05 was taken as significant for all statistical analysis.

Normal (Healthy adults) Reference Ranges of CBC parameters which were used in our study are mentioned below [9,10,13,16]:
 Hemoglobin: Male :13-17 g/dL and Female: 12-15 g/dL
 Total Red Blood cell Count (TRBC): Male : 4.35 – 5.65 million red cells per microliter (mcL)
 Female: 3.92 – 5.13 million red cells per microliter (mcL)
 Mean corpuscular volume (MCV): 80-100 fL
 Mean corpuscular hemoglobin (MCH): 0.4-0.5 fmol/cell
 Mean corpuscular hemoglobin concentration (MCHC): 30-35 g/dL
 Total White blood cells count (TWBC): $4 \cdot 10 \times 10^9/L$
 Total Platelets Count (TPC): $150-400 \times 10^9/L$
 Red blood cell distribution width (RDW): 11.5%-14.5%

RESULTS:

In our study, we surveyed five hundred adult people consisting equal number from male and female with preset questionnaires and found that 113 (22.6%) people were using mobile phones more than sixty minutes in 24 hours time (excessive users) where as 337 (67.4%) use daily but less than 60 minutes in 24 hours time. Similarly 22 (4.4%) use mobile occasionally not daily and 28 (5.6%) people neither have mobile phones, nor do they know their use and are non-users of mobile phones (Table-1, Chart-1). It was found that out of 113 no. of individuals who were habituated to excessive use of mobile phones 32 (28.3%) were detected of tachycardia and 26 (23.0%) people were found to have hypertension. Thus it was observed both tachycardia and hypertension were common in excessive users of mobile phones in comparison to nonusers (Table-2). Moreover on analysis of blood examination (CBC) reports of individuals with the excessive usage the abnormal blood parameters which were frequently observed were decrease Hb% (22.0%), decrease TRBC (16.0%), decrease TPC (17%) and increased red cell distribution width (RDW) in (14.0%) as shown in the picture (Chart-2). However blood count changes in MCV, MCH, MCHC and other parameters were found less pronounced, variable and not significant in this study therefore not included in the chart (Chart-2).

Table-1: Total Five hundred Individuals Surveyed were Grouped into four Groups

Groups	Time and frequency of use of Mobile phones	Number of Individuals	Percentage (%)
Group-A	Individuals who frequently use Mobile at least more than 60 minutes in 24 hours (excessive users)	113	22.6
Group-B	Individuals who use Mobile but less than 60 minutes in 24 Hours	337	67.4
Group-C	Individuals who use Mobile but only occasionally not every day	22	4.4
Group-D	Individuals who do not have Mobile Phone and do not know to use (non-users)	28	5.6

Table-2: Incidence of Tachycardia and Hypertension in various Groups

Groups	No. of Individuals	Tachycardia (Heart rate > 90/min)	Percentage (%)	Hypertension	Percentage (%)
Group-A	113	32	28.3	26	23.0
Group-B	337	41	12.2	47	13.9
Group-C	22	02	9.1	04	18.2
Group-D	28	02	7.1	02	7.1

Chart-1: Mobile phone users groups

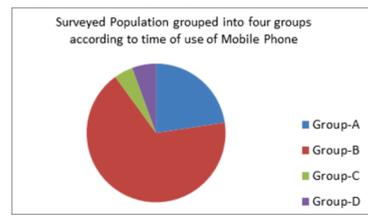
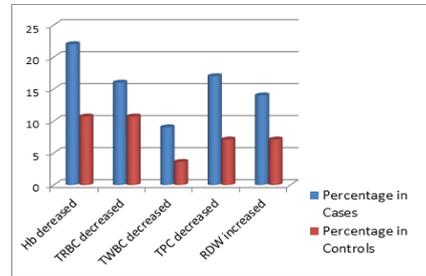


Chart-2: Comparison of Blood changes observed in Cases (Excessive Mobile Users) and Controls (Non users of Mobile)



DISCUSSION:

From our study, we found that 22.6% people were using mobile phones more than sixty minutes in 24 hours time (in a day) we called them as excessive users of mobile phones. We found Tachycardia in 28.3% and Hypertension in 23.0% in such individuals who were doing excessive use of mobile phones. Increased heart rate due to mobile phones were previously documented by the cardiologist Joel Kahn, M.D. The observation which is similar to that of Ekici B, Tanmıdı A who reported the effects of the duration of mobile phone use on heart rate variability parameters in healthy subjects [11,12]. We observed hypertension in 23% cases of excessive mobile phone users which correlates with observation of Braune S et al. [27]. But Choi et al. (2014) found no effect in adult to RF radiation emitted by mobile phones which is contrary to our study [28]. In this study we observed decrease in Hb% in 22% and decrease in total red cell count (TRBC) in 16% people who are excessive users of mobile phones similar findings were previously documented by Savopol T, et al [14,15]. Decrease total white blood cell count (TWBC/TLC) was found in 09% of excessive users of mobile phones, which is similar to the result by Ji S, Oh E et al [17]. We also found total platelet count (TPC) decrease in our observation which did not correlate with study of Giuseppe Lippi et al [18]. Red cell distribution width (RDW) was found increased in 14% individuals with excessive use of mobile phones. Similar observation was reported by Eleni Vagdatli, Vasiliki K. et al [19]. We observed significant abnormalities or changes in blood parameters due to exposure to radiation by excessive use of mobile phones. Some of our observations have also been proved in experimental animals [21] many of our observations in human were similar to findings reported by other authors earlier [20, 22, 23].

CONCLUSION:

The effects of mobile phones on human heart, blood pressure and blood parameters what we observed in this study could not conclusively be correlated. However we found tachycardia, hypertension, anaemia, thrombocytopenia and increased RDW were commonly associated with individuals who use mobile phones excessively.

RECOMMENDATION:

From the observations of this study, it is recommended that one should try to minimize the use of mobile phones to less than one hour a day for possibly ensuring a better health by avoiding frequent exposure to electromagnetic radiation from mobile phones.

LIMITATIONS OF THE STUDY:

The small sample size and short duration of the study remain the limitations of this study. Therefore it is recommended that further studies should be conducted using a large sample size with ample time duration in order to correlate changes in blood count which might have occurred due to excess use of mobile phones.

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Ethical approval: The study was approved by the institutional ethical committee.

Consent: Written informed consent were obtained from all the participants after explaining them detail of the study module.

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Conflicts of interest: Neither author has any conflicts of interest.

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