ORIGINAL RESEARCH

To investigate the impact of smartphone use on cardiovascular and hematological parameters in the adult population

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ABSTRACT

Aim: To investigate the impact of smartphone use on cardiovascular and hematological parameters in the adult population. **Materials and methods:** The sample was obtained from a research population consisting of 130 individuals who had been using mobile phones over the last 4 years and were monitored for the objectives of the study. The individuals' blood pressure was measured in a seated position using a Sphygmomanometer (Mercury). The total white blood cell count was determined using the Haemocytometer technique, with Turk's fluid used as the diluent. The respondents' mobile phone use duration, measured in hours, was taken into account for estimate and subsequent analysis. **Results:** The participants who used a mobile phone for less than or equal to 1 hour, 41 individuals had a systolic blood pressure (SBP) ranging from 100 to 120 mmHg, while 3 individuals had SBP ranging from 121 to 140 mmHg. Among the participants who used a mobile phone for 2-3 hours, 73 individuals had SBP ranging from 100 to 120 mmHg, while 11 individuals had SBP ranging from 121 to 140 mmHg. There were 25 participants who used a mobile phone for ≤1 hour and had diastolic blood pressure (DBP) between 70-80 mmHg. Additionally, there were 20 participants who had DBP between 81-90 mmHg. Among the 41 participants who used a mobile phone for 2-3 hours, their DBP was between 70-80 mmHg, while 44 participants had a DBP between 81-90 mmHg. A total of 44 subjects who used mobile phones for ≤1 hour had a total leukocyte count (TLC) ranging from 4000 to 11000 per cubic millimeter (Cumm), while only 1 subject had a TLC exceeding 11000 per Cumm. Additionally, 84 subjects who used mobile phones for 2-3 hours had a TLC ranging from 4000 to 11000 per Cumm, with 1 subject having a TLC of 11000 per Cumm. **Conclusion:** The majority of the participants in our research exhibited a WBC total count within the normal physiological range, with the exception of two subjects whose WBC total count was determined to be elevated above the normal range. This research shows that prolonged usage of mobile phones might affect and alter the autonomic balance, leading to an increase in sympathetic tone.

Keywords: TLC, Smartphone, Cardiovascular, hematological parameters

INTRODUCTION

Smartphones, contemporary touchscreen gadgets with many capabilities, have become an essential element of daily existence and have gradually spread across society[1]. Social media platforms provide immediate connections with friends and family, while also offering a diverse array of communication and entertainment applications[2]. Smartphones have been popular due to their diverse variety of features, which enable users to browse the Internet, travel to locations, send emails, play games, and use social networking platforms like Facebook and Twitter[2].

They are very portable and may be easily used at any given time and location. These characteristics have led to an overuse and reliance on smartphones, especially among younger age groups, which is referred to as smartphone addiction. This involves a strong want to use a smartphone frequently, potentially disrupting one's daily routines and tasks[3]. Nevertheless, several experts are reluctant to classify this behavior as an addiction, opting instead to characterize it as the problematic use of cellphones that has a detrimental impact on everyday life[4].

The worldwide mobile phone subscriptions surpassed 6 billion in 2022, and the figures are consistently rising on a daily basis[5]. According to reports, the current smartphone use rate in Saudi Arabia is at 72.8%[6]. An study conducted in Jeddah revealed that

89.1% of medical students had cellphones, and more than 90% used them for texting and making phone calls while operating a vehicle[7]. Problematic mobile phone usage has been seen in around 33% to 50% of users and has been associated with a range of health consequences. According to Alsanosi et al[8], a phone conversation lasting 60 minutes not only impacts the ability to hear, but also leads to headaches, vertigo, and tinnitus[9]. Furthermore, it has been shown that it diminishes the quality of sleep and has a detrimental impact on mood and energy levels.

Prolonged and consistent usage of mobile phones might adversely affect the biological system, particularly the autonomic nerve system[10]. Mobile phones operate wirelessly using radio-frequency waves, eliminating the need for cables. Mobile phones generate electromagnetic radiation that might potentially affect the autonomic, cardiovascular, endocrine, blood, and reproductive systems[11]. Hence, this research was carried out to ascertain the impact of mobile phone radiation on cardiovascular and hematological parameters in the young adult population.

MATERIALS AND METHODS

The research was carried out at the Department of Physiology. The sample was obtained from a research population consisting of 130 individuals who had been using mobile phones over the last 4 years and were monitored for the objectives of the study. The individuals' blood pressure was measured in a seated position using a Sphygmomanometer (Mercury). A 5-minute rest period was provided prior to recording the blood pressure. All the participants were in good health and none of them were using any chronic medication. The total white blood cell count was determined using the Haemocytometer technique, with Turk's fluid used as the diluent. Cell enumeration was performed manually using a compound microscope .

The daily duration of mobile phone use was assessed retrospectively using the individual's telephone billing information. The daily duration of mobile phone usage was automatically estimated by dividing the total duration of calls. The respondents' mobile phone use duration, measured in hours, was taken into account for estimate and subsequent analysis.

STATISTICAL ANALYSIS

The data were examined using the statistical package for social science software. The data was analyzed using a suitable statistical chi-square test. A significance level of P-value <0.05 was used to determine statistical significance.

RESULTS

Table 1 indicates that out of the total participants, 111 were male and 19 were female, accounting for 85.38% and 14.62% of the total accordingly.

Out of the total number of participants, 7 were below or equal to 20 years old, making up 5.38% of the group. There were 111 subjects between the ages of 20 - 25, accounting for 85.38% of the group. Additionally, there were 10 subjects between the ages of 25 - 30, making up 7.69% of the group. Lastly, there were 2 subjects between the ages of 30 -35, totaling 1.54% of the group.

Out of the total number of subjects, 45 subjects (34.62%) used their mobile phones for less than or equal to 1 hour. 65 subjects (50%) used their mobile phones for 2 hours. 20 subjects (15.38%) used their mobile phones for 3 hours. None of the subjects used their mobile phones for 4 or more hours.

Table1: Basic parameter of the participants

Gender	Number of participants=130	Percentage
Male	111	85.38
Female	19	14.62
Age(years)		
Below 20	7	5.38
20-25	111	85.38
25-30	10	7.69
30-35	2	1.54
Duration of mobile phone usage (continuous in hours)		
≤ 1	45	34.62
2	65	50
3	20	15.38
>4	0	0

Table 2 indicates that none of the individuals had a total leukocyte count below 4000/ Cumm. 128 subjects had a total leukocyte count between 4000-11000/ Cumm, which accounts for 98.46% of the total subjects. Only 2 subjects had a total leukocyte count over 11000/ Cumm, representing 1.54% of the total subjects.

Table 2: Total leukocyte(WBC)countof the participants

TLC(perCumm)	Number of participants =130	Percentage
<4000	0	0
4000-11000	128	98.46
>11000	2	1.54

Table 3 indicates that out of the total number of participants, 71 individuals had systolic blood pressure ranging from 100-120 mmHg, which accounts for 54.62% of the total subjects. Additionally, 49 participants had systolic blood pressure ranging from 121-140 mmHg, representing 37.69% of the total subjects. Furthermore, 10 participants had systolic blood pressure beyond 141 mmHg, making up 7.69% of the total participants.A total of 63 participants, accounting for 48.46% of the total, had diastolic blood pressure between 70-80 mmHg. Similarly, 62 participants, representing 47.69% of the total, had diastolic blood pressure between 81-90 mmHg. Additionally, 5 participants, making up 3.85% of the total, had diastolic blood pressure greater than 90 mmHg.

Table-3: Systolic and Diastolic blood pressure of the participants

Systolic blood pressure(mmHg)	Number of participants =130	Percentage
100-120	71	54.62
121-140	49	37.69
>140	10	7.69
Diastolic blood pressure (mmHg)		
70-80	63	48.46
81-90	62	47.69
>90	5	3.85

Table 4 indicates that among the participants who used a mobile phone for less than or equal to 1 hour, 41 individuals had systolic blood pressure (SBP) ranging from 100 to 120 mmHg, while 3 individuals had SBP ranging from 121 to 140 mmHg. Among the participants who used a mobile phone for 2-3 hours, 73 individuals had SBP ranging from 100 to 120 mmHg, while 11 individuals had SBP ranging from 121 to 140 mmHg. The p-value was 0.12, which is more than 0.05, indicating that the result obtained above was not statistically significant.

There were 25 participants who used a mobile phone for ≤1 hour and had diastolic blood pressure (DBP) between 70-80 mmHg. Additionally, there were 20 participants who had DBP between 81-90 mmHg. Among the 41 participants who used a mobile phone for 2-3 hours, their DBP was between 70-80 mmHg, while 44 participantshad a DBP between 81-90 mmHg. The p-value obtained was 0.22, which is more than the significance level of 0.05. Therefore, the result mentioned before is not considered statistically significant.

Table-4: Duration of continuous usage(hours) of mobile phone by the subjects and their Systolic and Diastolic blood pressure(mmHg)

Duration (Hours)	Systolic blood pressure (mmHg)			Number of participants	Chi-square test value	p-value
	100-120	121-140	Above 140			
≤1	41	3	1	45	1.21	0.12
2-3	73	11	1	85		
Total	114	14	2	130		
Duration (hours)	**Diastolic BP (mmHg)**			**Number of participants**	**Chi-square test**	**p-value**
	70-80	81-90	>91		1.65	0.22
≤1	25	20	0	45		
2-3	41	44	1	85		
Total	66	64	1	130		

Table5: Duration of continuous usage (hours) of mobile phone by the subjects and their total leukocyte count (TLC) (per Cumm)

Duration(hours)	TLC(per Cumm)		Number of participants	Chi-squaretest	p-value
	4000-11000	>11000			
≤1	44	1	45	**0.17**	**0.32**
2-3	84	1	85		
Total	128	2	130		

A total of 44 subjects who used mobile phones for ≤1 hour had total leukocyte count (TLC) ranging from 4000 to 11000 per cubic millimeter while only 1 subject had TLC exceeding 11000 per Cumm. Additionally, 84 subjects who used mobile phones for 2-3 hours had TLC ranging from 4000 to 11000 per Cumm, with 1 subject having TLC of 11000 per Cumm. The p-value was 0.32, which is more than 0.05. Therefore, the result obtained above was not statistically significant.

DISCUSSION

This research aimed to assess the impact of mobile phone use on the adult population. Our research indicated that there was no substantial impact of mobile phone use on the white blood cell count in the patients we investigated. The majority of participants in this research used mobile phones for a continuous doration of two hours every day. The brief duration of electromagnetic radiation exposure to the body may not be a significant influence in either lowering or raising the total white blood cell count among the patients examined. Nevertheless, two participants had an elevated white blood cell count that above the usual limit. The variance in the finding of WBC count may be attributed to variables such as an individual's phenotype or genotype, environmental conditions, the kind of smart phones used, and the specific type of radiation generated by these devices. These factors might potentially have thermal or non-thermal impacts on various types of blood cells.

Research done in Baghdad, Iraq, exposed both smoker and non-smoker individuals to gamma radiation. It was discovered that increasing the doses of γ-rays led to a decrease in the levels of white blood cells (WBCs), lymphocytes, and neutrophils in smokers compared to non-smokers. This confirms that these cells are more delicate, feeble, and less resistant to external stimuli such as gamma rays, which cause cellular damage and diffuse harm throughout the body. Small amounts of γ-rays provide a random health hazard, which is defined as the likelihood of developing cancer and genetic harm when assessing radiation exposure. Administration of high dosages of it results in deterministic consequences, characterized by the inevitable occurrence of severe acute tissue damage[12]. Contrary to the findings of earlier research done by Sih et al [12], our results do not align with regards to the haematological parameter.

The results of our investigation regarding the haematological parameter of total white blood cell counts are consistent with the findings of a previous study done by Sani A. et al. This study investigated the effects of electromagnetic radiation from mobile phones on haematological parameters in male Albino Rats[13]. The results of our research on hematological parameters align with those of a prior investigation performed by Suleyman et al. This earlier study examined the impact of very low frequency electromagnetic fields on hematological and immunological markers in welders[14].

The correlation between mobile phone use and hypertension is noteworthy due to its role as a contributing factor in the onset of cardiovascular illnesses. The increase in mobile phone use has raised worries over their potential negative impact on human health[15]. Due to the proximity of mobile phones to the head, several studies have investigated the potential hazards they may pose to the brain, including impacts on cognitive functioning and sleep patterns. Several studies have shown that prolonged exposure to low-intensity electromagnetic fields (EMF) is linked to a higher likelihood of experiencing cardiac arrhythmias, acute myocardial infarction, cardiovascular mortality, and changes in the daily fluctuations of blood pressure[15].

Our results on cardiovascular parameters align with those of the earlier research performed by Aghav et al on the impact of mobile phone radiation on blood pressure owing to environmental pollution [16]. The results of our investigation regarding cardiovascular parameters align with those of the earlier study done by Basandrai et al on the non-thermal effects of mobile phone radiation on human heart rate and blood pressure. In this research, most of the participants did not use mobile phones for extended periods of time, which prevented the investigation of the consequences of continuous mobile phone usage. Additional research is necessary to investigate the impact of long-term smart/mobile phone use on the population, including individuals of all ages and genders, via the investigation of heart rate variability (HRV) on a significant sample size.

CONCLUSION

The majority of the participants in our research exhibited a WBC total count within the normal physiological range, with the exception of two subjects whose WBC total count was determined to be elevated above the normal range. This research shows that prolonged usage of mobile phones might affect and alter the autonomic balance, leading to an increase in sympathetic tone. Subjects who have used mobile phones for a long time are found to have a rise in sympathetic tone and a reduction in parasympathetic tone.

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