

ORIGINAL ARTICLE

Specific Absorption Rate (SAR) value of mobile phones: An awareness study among mobile users

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Citation

Varshney S, Malhotra M, Sharma S, Aggarwal P. Specific Absorption Rate (SAR) value of mobile phones: An awareness study among mobile users. Indian J Comm Health. 2018; 30, 2: 156 - 162.

Source of Funding: Nil **Conflict of Interest:** None declared

Article Cycle

Received: 30/05/2018; **Revision:** 12/06/2018; **Accepted:** 21/06/2018; **Published:** 30/06/2018

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Abstract

Background: Mobile phone is an inevitable part of one's life. Once been luxury has now become necessity. It's been used by all age group people for different application apart from calling and texting. But while using cell phone for talking or being connected to someone the user gets exposed to harmful Electro Magnetic Radiations. The exposure rate to these radiations vary from handset to handset. When cell phones are used in close proximity to human body, the radiations emitted from cell phones penetrate deep inside the human skin. Penetrated radiations produce induced electric field inside the body, resulting in absorption of power, which can be analyzed using a parameter called Specific Absorption Rate (SAR). But still one question arises in mind that are people really aware of Safety standard especially SAR value. What does SAR value mean? It is defined as the power absorbed per mass of tissue and has units of watts per kilogram (W/kg) and in a way defines safety range of mobile handset.

Aim & Objective: To measure the knowledge and awareness of SAR value of handset and the factors that influence awareness of SAR value. **Settings and Design:** Cross-sectional study based on primary survey. **Methods and Material:** The study subjects comprised of individuals that visited the study site over a period of 18 months their awareness on SAR was assessed using a structured questionnaire. The questionnaire was designed to record the responses on awareness of SAR values. **Statistical analysis:** Simple data analysis techniques were adopted such as descriptive statistics. **Results:** Out of 738 respondents only 12 (1.63%) were aware about SAR value and only 9 (1.22%) knew the SAR value of their handset. **Conclusions:** There is a need to create awareness about SAR.

Keywords

EMR; SAR value; Handset; Awareness

Introduction

Mobile phones often referred as a 'health time bomb' are a part of our lives to such an extent that they are not merely restricted to the elite but is also

one of the most common gadget owned by almost every individual. To communicate with the cellular network, mobile phones emit low levels of radiowaves (also known as Radio Frequency or 'RF' energy) when being used. While using mobile phone

we are getting exposed to EMR (Electro Magnetic Radiations), which are dangerous and becoming a potential serious health risk. Governments around the world have adopted comprehensive international safety guidelines, developed by independent scientific organizations, governing the exposure to RF energy. Mobile phones have to be designed to operate within these stringent limits as per international safety guidelines. Every mobile phone model is tested for radio wave emissions. A measurement is made using an internationally agreed method that meets government and regulatory standards. This gives the SAR value, a mobile phone's Specific Absorption Rate which is a measure of the amount of Radio Frequency (RF) energy absorbed by the body when using the mobile phone handset. It is a measure of the maximum energy absorbed by a unit of mass of exposed tissue of a person using a mobile phone, over a given time or more simply the power absorbed per unit mass of human tissue. (1)

SAR values are usually expressed in units of watts per kilogram (W/kg) measured in either 1g or 10g of tissue. (2) While there may be differences in SAR levels among mobile phone models, all of them must meet RF exposure guidelines for safety reasons.

International Exposure limits for RF fields (1800 MHz) (3)

Country	Exposure Limit
USA, Canada and Japan	12 W/m ²
Australia	9 W/m ²
Belgium	2.4 W/m ²
Israel	1.0 W/m ²
New Zealand	0.5 W/m ²
Germany	0.45 W/m ²
China	0.4 W/m ²
Bulgaria	0.2 W/m ²
Poland, France, Hungary	0.1 W/m ²
Switzerland, Italy	0.095 W/m ²
India	1.6 W/Kg

The DoT (Department Of Telecommunications) has also set a deadline that after September 1, 2013, only handsets with revised SAR value would be permitted to be manufactured or imported. (4)

The widespread use of mobile phones has given rise to apprehension regarding the possible hazardous health effects of high-frequency electromagnetic fields (EMFs) on auditory function. (5,6)

World Health Organization (WHO) has classified cell phone radiation as a Class 2B Carcinogen 2 — the same class as the pesticide dichloro diphenyl-trichloroethane (DDT), naphthalene, and lead. (7)

Many people mistakenly assume that using a cell phone with a lower reported SAR value necessarily reduces the adverse effects of a user's exposure to RF emissions, or is safer than using a cell phone with a high SAR value, Federal Communications Commission (FCC) has recommended SAR values. (8,9)

Aims & Objectives

To assess the knowledge and awareness about Specific Absorption Rate (SAR) among mobile phone users.

Material & Methods

The research study is more of a behavioral study and so it is qualitative as well as quantitative in nature. It includes a descriptive and exploratory research.

This was a cross-sectional study that was based on primary survey of 738 respondents visiting the hospital, during a period of 18 months, using a structured questionnaire. The questionnaire was designed to record the responses on awareness of SAR values.

The socio-demographic profiles of the respondents were also recorded on the parameters such as gender, age, education level, occupation, mobile usage and monthly income. Simple data analysis techniques were adopted such as descriptive statistics.

Results

Socio - Demographic Profile: A total of 738 (90.44%) individuals responded out of 816 approached. They were in age ranged from 18-45 years, with maximum respondents between 20-30 years (59.22%), male respondents (61.65%) were more than females (32.25%), most of the respondents were in service (42.14%) or were students (31.17%). Majority (97.43%) of the respondents were literate, 34.82% were Graduate, 29.81% were intermediate and 18.42% were Postgraduates. Monthly family income: 80.52 % had monthly family income between 10,000 – 40,000. With 24.66% (10,000 – 20,000), 15.18% (20,000 – 30,000), 14.36% (< 10,000) and 12.06 %

(30,000 – 40,000). 8.67% did not disclose their monthly family income.

Duration of usage of mobile phone (in years): 85.63% had been using mobile phone from 2-10 years {49.05% (6-10 years); 36.58% (2-5 years)}, with average usage/day (in minutes) ranging from 0 - 900 minutes per day. 62.62 % used phone for less than 60 minutes per day {35.78% (1-30 minutes), 26.84% (31-60 minutes)}, followed by 12.48 % (91-120 minutes/day).

Awareness of SAR value: Out of 738 respondents only 12 (1.63%) were aware about SAR value and only 9 (1.22%) knew the SAR value of their handset. Maximum respondents in the study were between 20-30 years (437/738- 59.22%), out of which only (10/437) 2.29% were aware about SAR. The majority of the respondents who were aware of SAR values were in the age below 30 years (11/12 – 91.67%). Males (1.98%) are comparatively more aware than females (1.06%) about SAR. People in service were more aware (2.89%) about SAR in comparison to students (0.43%). Education had a role in knowledge and awareness of SAR as 8/12 were graduates and 4/12 were postgraduates. Monthly family income did not play a significant role in awareness as it ranged from 1.79 – 5.56%, (Income range 20,000 – 70,000 per month), with maximum awareness 5.56% in 40,000-50,00 and minimum 1.79% in 20,000 – 30,000 income range. Duration of usage in years was not related to awareness about SAR, as maximum users were for < 10 years, and awareness was 1.85 % (2-5 years) and 1.66 % (6-10 years). Maximum users were for < 60 minutes per day (462/738- 62.60%), but awareness about SAR was in only 03/462 i.e. 0.65%.

Discussion

As only 1.63% of mobile users are aware about SAR value, which is a safety limit of mobile handset and as per Government of India directives from September 1, 2013 onwards it is mandatory for every mobile phone brand to disclose the SAR value of respective handset which cannot be more than 1.6W/Kg.

Specific Absorption Rate (SAR) testing procedure is being finalized by Telecom Engineering Centre (TEC). The SAR test laboratory has also been set up in TEC, Delhi, for testing of revised SAR standards of mobile handsets imported or manufactured in India. (10)

Till now very few studies have been conducted on knowledge and awareness about SAR value in India. In a study conducted in 2013, of the total 200 respondents surveyed, 62 respondents had awareness of SAR values of mobile phone i.e. 31% of total respondents, which is very high as compared to our study i.e. 1.63 %. (11) In another study conducted in 2017 on college students it was found that the level of awareness for SAR was 12%. (12) The reason in so much of variability may be due to different socio-demography and literacy status of study groups.

Moreover, the 2017 survey revealed 11% of the respondents were aware of any radiation limit (permissible value) that has been assigned for MPR. Interestingly, 66% of the respondents were found to be willing to change their mobile phone if they found that it is emitting radiations beyond the permissible value. (12)

Males are comparatively more aware than females (11), which is in coherence with our study. The majority of the respondents who were aware of SAR values were in the age below 45 years. Educated people are comparatively more aware of SAR. It was also evident that about 11% respondents, with awareness on SAR values, were educated upto graduate level education. As far as occupations & income level of the consumers are concerned, majority of the respondents belong to service class and higher income levels and had higher level of awareness of SAR values. (11) Our study approves the statements.

A survey sheet was prepared and 100 students randomly selected from various colleges of Delhi were surveyed during January-February 2017 on their mobile phone usage and awareness. Almost half the surveyed population was noted to be spending more than 16 hours per day with the mobile phone close to their bodies. Only 23% of the surveyed population reported spending less than 8 hours per day with their mobile phones. (12) In our study maximum users were for < 60 minutes per day (462/738- 62.60%), reason being our study group had vast socio-demographic variation compared to this study which included young, college graduates only.

Findings of regression analysis of our study indicate that gender, education level, monthly income level were important socio-demographic factors affecting

the awareness level of the consumers. Result indicates that males were more likely to be aware than females. Education of the consumers have significant role to play on awareness level. Consumer with more monthly income is more likely to have awareness on SAR values.

Conclusion

There is a need to create awareness about SAR. The SAR value information of the mobile handset should be available on the manufacturer's website and in the handset manual. The information on SAR values should also be made available to mobile subscribers at the handset point of sale.

Recommendation

All mobile handsets manufactured and sold in India or imported from international destinations should be checked for compliance of the SAR limits permitted in India. With the recent popularity of mobile phone use among the young people, and therefore potentially longer lifetime exposure, further studies with larger cohort are required to fill the gaps in the knowledge and awareness regarding safety measures against harmful effects of EMFs from mobile phones on ear.

Limitation of the study

The study may suffer from the common limitations of a subjective research. The quantification problem, imperfections of data and the intricacy involved in the statistical analysis are in a way inevitable in all such behavioral science researches.

Main source of data being the primary source of data, manipulation at the respondent's end cannot be averted. Effect of uncontrollable extraneous variables may also influence the respondents sub-consciously.

The published and unpublished secondary data available on Internet has its own limitations, as many of them are the author's own views and not a generalized perception. Further, the respondents often times do not portray a true picture and opinion.

The conclusions, therefore, are subject to aforesaid constraints and are only exploratory and suggestive in nature.

Relevance of the study

In India people are unaware of mobile phone hazards, one important parameter to be considered

in buying a mobile phone is SAR value. It is recommended that people should use mobile phone as minimum possible. Avoid giving mobile phones to children as the effect is more on them.

Authors Contribution

All authors have contributed in this article.

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Tables**TABLE 1 SOCIO – DEMOGRAPHIC PROFILE OF THE RESPONDENTS**

Age (Years)	M	F	Frequency	%
18-20	47	58	105	14.22
21-25	126	107	233	31.57
26-30	141	63	204	27.65
31-35	82	27	109	14.77
36-40	51	26	77	10.43
41-45	8	2	10	1.36
Total	455	283	738	100
Gender	Frequency			%
Male	455			61.65
Female	283			38.35
Total	738			100
Occupation	Frequency			%
Student	230			31.17
Service	311			42.14
Businessman	51			6.91
Home maker	70			9.49
Other	76			10.29
Total	738			100
Education	Frequency			%
Illiterate	19			2.57
Primary School	8			1.08
Middle School	41			5.57
High School	56			7.59
Intermediate	220			29.81
Graduate	257			34.82
Postgraduate	136			18.42
Other	1			0.14
Total	738			100
Monthly Income (Rs)	Frequency			%
<10000	106			14.36
10000-19999	182			24.66
20000-29999	112			15.18
30000-39999	89			12.06
40000-49999	54			7.32
50000-59999	54			7.32
60000-69999	27			3.66
70000-79999	9			1.22
80000-89999	11			1.49
90000-99999	1			0.13
≥100000	29			3.93
Not Reported	64			8.67
Total	738			100

TABLE 2 DURATION OF USAGE OF MOBILE PHONE (IN YEARS)

Duration of usage (years)	Frequency	%
2 - 5	270	36.58
6 - 10	362	49.05
11 - 15	94	12.74
16 - 20	11	1.49
21 - 25	1	0.13
Total	738	100

Average usage/day (minutes)	Frequency	%
1 - 30	264	35.78
31 – 60	198	26.84
61 – 90	48	6.6
91 – 120	92	12.48
121 – 150	17	2.4
151 – 180	47	6.38
181 – 210	1	0.13
211 – 240	28	3.79
241 – 270	3	0.4
271 – 300	14	1.89
301 – 330	0	0
331 – 360	8	1.08
361 – 390	2	0.27
391 – 420	3	0.4
421 – 450	1	0.13
451 – 480	3	0.4
481 – 510	1	0.13
510 – 540	1	0.13
541 – 570	0	0
571 – 600	5	0.69
601 – 700	0	0
701 – 800	1	0.13
801 – 900	1	0.13
Total	738	100

TABLE 3 DURATION OF USAGE OF MOBILE PHONE (IN YEARS)

Demographics	Number	SAR Awareness			
		Aware		Unaware	
		n	%	n	%
Age distribution					
18-20	105	01	1%	104	99%
21-25	233	07	3%	226	97%
26-30	204	03	1.47%	201	98.53%
31-35	109	01	1%	108	99%
36-40	77				100%
41-45	10				100%
Sex distribution					
Male	455	09	1.98%	446	98.02%
Female	283	03	1.06%	280	98.94%
Occupation					
Student	230	01	0.43%	229	99.57%
Service	311	09	2.89%	302	97.11%
Businessman	51	01	1.96%	50	98.04%
Home maker	70	01	1.43%	69	98.57%
Other	76			76	100%
Educational Qualification					
Illiterate	19			19	100%
Primary School	8			8	100%
Middle School	41			41	100%
High School	56			56	100%
Intermediate	220			220	100%
Graduate	257	08	3.11%	249	96.89%
Postgraduate	136	04	2.94%	132	97.06%

Other	1			1	100%
Monthly Family Income (Rs)					
<10000	106			106	100%
10000-19999	182			182	100%
20000-29999	112	02	1.79%	110	98.21%
30000-39999	89	03	3.37%	86	96.63%
40000-49999	54	03	5.56%	51	94.44%
50000-59999	54	02	3.70%	52	96.30%
60000-69999	27	01	3.70%	26	96.30%
70000-79999	9			9	100%
80000-89999	11			11	100%
90000-99999	1			1	100%
≥100000	29			28	100%
Not Reported	64				100%
Duration of usage (years)					
2 - 5	270	05	1.85%	265	98.15%
6 - 10	362	06	1.66%	356	98.34%%
11 - 15	94			94	100%
16 - 20	11	01	9.09%	10	90.91%
21 - 25	1			1	
Average usage of mobile phone (in minutes/day)					
1 - 30	264	02	0.76%	262	99.24%
31 – 60	198	01	0.51%	197	99.49%
61 – 90	48	03	6.25%	45	93.75%
91 – 120	92			92	100%
121 – 150	17			17	100%
151 – 180	47	02	4.26%	45	95.74%
181 – 210	1			1	100%
211 – 240	28			28	100%
241 – 270	3	01	33.33%	2	66.67%
271 – 300	14	01	7.14%	13	92.86%
301 – 330	0			0	100%
331 – 360	8	01	12.5%	7	87.5%
361 – 390	2			2	100%
391 – 420	3			3	100%
421 – 450	1			1	100%
451 – 480	3			3	100%
481 – 510	1			1	100%
510 – 540	1			1	100%
541 – 570	0			0	100%
571 – 600	5	01	20%	4	80%
601 – 700	0			0	100%
701 – 800	1			1	100%
801 – 900	1			1	100%