Quality of semen in young adult males who carry mobile phone in their front pocket of trousers or jeans

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Abstract

Background: The number of mobile users is rising rapidly worldwide (6 billion). Mobile phones emit low frequency electromagnetic radiation, posed a serious threat to the male as well as his reproductive health.

Methods: The present study is a retrospective cohort study conducted in 2 months period to study the semen parameters of 60 young healthy adult males in age range of 21 – 30 years. They were grouped into Group 1 and Group 2 depending upon the habit of carrying their mobile phones either in the front pocket of their trousers or jeans (Group 1) & those who carried the mobile phone in the pocket of their shirts or T-shirts (Group2). Semen analysis was performed, routine semen parameters were noted. The findings of the two groups were tabulated and mean values, standard deviation, along with P-values for Unpaired T Test in group 1 and group 2 were performed.

Results: It was found that the sperm count, motile sperm count, percentage motility, grade of motility, and percentage of morphologically normal sperms, were significantly lowered in group 1 as compared to group 2 (p < 0.05).

Conclusion: We found that the sperm parameters and overall grade of motility were significantly lower in the group carrying mobile phones in the front pocket of their trousers or jeans without significant difference in the semen volume. Long term studies can be conducted to assess impact of decline in quality of semen on the fertility potential of young men.
Introduction
Mobile phone use has rapidly increased worldwide in recent few years. According to a report there were more than 4.3 billion mobile phone users throughout the world as of June 2009[1]. In India, it is reported that the number of mobile phone users have risen to 929.37 million in May 2012 [2].

According to several reports there is a significant decline in the semen parameters over the past 50 years. The causative agents may be chemical substances, ionizing radiation, stress and also electromagnetic waves [3]. There are growing concerns about the possible negative effects of radiofrequency (RF) electromagnetic waves (EMW) emitted by the mobile phone on human health. This radiation is absorbed by the human body and is measured by the Specific Absorption Rate (SAR). Several studies explored the effects due to electromagnetic radiation from mobile phone on various aspects of human health as thermal effects, non thermal effects, blood brain barrier effects and cognitive effects. One of the major concern is these RF-EMW may interact with the human tissues and have adverse effects particularly on fertility and reproduction. Recent studies have shown that RF-EMW may disturb testicular function and alter conventional as well as nonconventional sperm parameters[4]. As these underlying causes are environmental thus they are preventable.

The young population forms a major part of mobile phone users and as they are just in the beginning of their reproductive phase of life the possible hazardous effect upon semen parameters like sperm count, sperm motility, sperm morphology and viability is of much concern. It is a common observation that most of the young males carry their mobile phone in the front pocket of their jeans or trousers. The distance between the mobile phone & testicles is decreased in men who carry mobile phones in their trouser pocket as compared to those who carry it in their shirt pockets. The present study was planned to assess the effects of carrying mobile phone in the front pocket of trouser or jeans as compared to those carrying it in their shirt pocket.

Materials and Methods
The present study is a retrospective cohort study conducted in a period of 2 months from September 2013 to October 2013 as a short term studentship (STS) project for the year 2013 by ICMR. The study was conducted in Department of Physiology at Peoples College of Medical Sciences & Research Centre, Bhopal. Clearance was obtained from the Institutional Ethics Committee (IEC) before commencing the project.

A total of 60 young adult healthy male subjects were recruited for this study from the employees of the various constituent institutes of Peoples University, Bhopal. All the subjects selected were in the age range of 21 – 30 years who use mobile phone for minimum 1 year period and minimum two hours a day. All the subjects were explained about the nature of the study and the investigation involved in details and those volunteering were selected. An informed consent form was filled up by all voluntary participants in the presence of a witness. A thorough clinical examination was done and those suffering from any febrile illness, conditions like varicocele, hydrocele, having any past history of surgery in genitourinary region, taking any medication, alcoholics and smokers were excluded from the study.

A questionnaire containing questions related to usage of mobile phone like duration of use, habit of carrying, use of belt pouch or Bluetooth headset was filled from the subjects. Based upon the responses, the subjects were classified as belonging to either group 1 or group 2. Group 1 comprised of those subjects who were in habit of carrying their mobile phones in the front pocket of their trousers or jeans. Group 2 comprised of those subjects who were in habit of carrying their mobile phones in the pocket of their shirts or T-shirts. After explaining about the study in detail, informed consent was obtained from the subjects who volunteered for the study.

All the subjects were asked to observe abstinence from sexual abstinence for 4 days prior to the semen analysis. Semen samples were collected in a wide mouthed sterile container by masturbation after local cleaning. A code number was allotted to all the samples. The collected sample was kept at room temperature and allowed to liquefy for about 30 – 40 minutes. Routine semen analysis was performed according to the guidelines of WHO[5] in the postgraduate laboratory of department of Physiology, Peoples College of Medical Sciences & Research Center, Bhopal.

The semen parameters determined after routine semen analysis were: Volume in ml, Sperm count per ml, Motile sperm count per ml, Percentage motility, Grade of motility, Percentage of morphologically normal sperms, any other cells as epithelial cells, testicular cells, WBCs and agglutination, if any. Papanicolaou stain was used to determine the morphology of spermatozoa. The findings of the two groups were tabulated and mean values were calculated. Appropriate statistical tests including mean values, standard deviation, along with values for Unpaired T test in group 1 and group 2 were performed.
Result
The routine semen parameters like volume of semen, sperm count per ml, motile sperm count per ml, percentage of motile sperm, grade of motility and percentage of morphologically normal sperms were assessed in 30 young male subjects who carried their mobile phones in their front pocket of trousers and compared those with the semen parameters of 30 young male subjects who carried their mobile phones in their shirt pocket.

The mean and standard deviation were calculated as shown in table 1. Unpaired T test was applied and P – values for significance were obtained. There was no significant difference in the age and volume of semen in both the groups.

Table 1. Showing the mean values and standard deviation, along with P-values for Unpaired T test in group 1 and group 2. (*p < 0.05)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Group 1</th>
<th>Group 2</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>24.80 ± 2.29</td>
<td>24.67 ± 2.18</td>
<td>.819</td>
</tr>
<tr>
<td>Volume</td>
<td>2.17 ± 0.791</td>
<td>2.63 ± 1.03</td>
<td>.054</td>
</tr>
<tr>
<td>Sperm count/ml</td>
<td>85.33 ± 19.95</td>
<td>101.33 ± 31.70</td>
<td>.023*</td>
</tr>
<tr>
<td>Motile sperm count/ml</td>
<td>53.00 ± 11.78</td>
<td>78.33 ± 27.80</td>
<td>.001*</td>
</tr>
<tr>
<td>% Motility</td>
<td>64.44 ± 16.06</td>
<td>77.29 ± 12.46</td>
<td>.001*</td>
</tr>
<tr>
<td>Grade of Motility</td>
<td>2.07 ± 0.58</td>
<td>2.47 ± 0.51</td>
<td>.006*</td>
</tr>
<tr>
<td>% Morphology</td>
<td>60.67 ± 14.36</td>
<td>69.33 ± 12.78</td>
<td>.017*</td>
</tr>
</tbody>
</table>

Figure 1: A mean sperm count million/ml, B mean motile sperm count million/ml, C mean percentage of motile sperm, D mean percentage of morphologically normal sperm in groups 1 & 2.
The mean sperm count in group 1 was 85.33 ± 19.95 million per ml, whereas in group 2 the sperm count was 101.33 ± 31.70 (figure-1A). This difference in group 1 and group 2 was statistically significant (P < 0.05).

The mean motile sperm count in group 1 was 53.00 ± 11.78 million per ml, whereas in group 2 the motile sperm count was 78.33 ± 27.80 (table 1, figure-1B). This difference in group 1 and group 2 was statistically significant (P < 0.05).

The mean percentage motile of sperm in group 1 was 64.44 ± 16.06, whereas in group 2 the percentage of motile sperm was 77.29 ± 12.46 (table 1, figure-1C). This difference in group 1 and group 2 was statistically significant (P < 0.05).

The mean percentage of morphologically normal sperm in group 1 was 60.67 ± 14.36, whereas in group 2 the percentage of morphologically normal sperm was 69.33 ± 12.78 (table 1, figure-1D). This difference in group 1 and group 2 was statistically significant (P < 0.05).

The grade of motility was also significantly reduced in group 1 as compared to group 2. The mean grade of motility in group 1 was 2.07 ± 0.58, whereas in group 2 it was 2.47 ± 0.51 (table 1, figure-2). This difference in group 1 and group 2 was statistically significant (P < 0.05).

**Discussion**

The mobile phones more commonly used operate at a frequency of 850 to 1800 MHz. The radiant energy is absorbed by human body tissues and organs by aerial effect and/or coupling the radiofrequency signals and/or resonant absorption [6].

The analog phones operate at 450-900 MHz, digital phones (GSM) at 850-1900 MHz and third generation phones at approximately 2000 MHz [7]. These frequencies probably affect the structure and function of the cell membrane and cytoplasm inducing changes in the electrophysiology of the living cells.

In normal physiological conditions, spermatogenesis is a balanced process of division, maturation, & storage of cells which is particularly vulnerable to the chemical, physical & environmental stimuli. Especially sensitive could be the cytoskeleton composed of charged protein such as actin, intermediate filaments microtubules. Cytoskeleton is a functional & structural part of the cell that has important role in the sperm motility & is actively involved in the morphological changes that occur during mammalian spermatogenesis [8].

As Leydig cells are one of the most vulnerable cells to electromagnetic waves, injury to Leydig cells may affect spermatogenesis. Increase in tissue or body temperature upon exposure to EMW may also result in reversible disruption of spermatogenesis [9]. As the distance between the source of emission of electromagnetic waves and testicles in very less when mobile phone is carried in trouser pockets as compared to when carried in shirt pocket, increase in the testicular temperature may also be one of the important factor affecting semen parameters adversely.

It has been reported that damage to sperm chromatin has a negative effect on sperm motility [10]. Several researchers have reported that the EMWs from mobile phones exert an oxidative stress upon spermatozoa [11,12,13]. It is also postulated that a decrease in melatonin, an antioxidant, predispose the spermatozoa to oxidative damage [14]. Scrotal hyperthermia is another mechanism that can lead to damage to semen parameters. It is known fact that testicular temperature is 2-3° C lower than rectal temperature and optimal temperature for spermatogenesis is considered to be 35° C [15].
Thus men who carry mobile phones in trouser pocket would have their spermatogenesis affected and hence lower sperm count and motility. The present study was undertaken to study the semen parameters of 60 young healthy adult male in the age range of 21-30 yrs. They are grouped into Group 1(n=30) who carried mobile phone in their front pocket of trousers & Group 2 (n=30) who carried their mobile phone in their shirts or T shirt’s pocket. All semen parameters were significantly lower in Group 1 & overall grade of motility was lowered.

**Conclusion**

We found that the sperm parameters i.e sperm count, motile sperm count, percentage of motile sperm, percentage of morphologically normal sperms and overall grade of motility were significantly lower in the group carrying mobile phones in the front pocket of their trousers or jeans. However, there was no significant difference in the volume of semen in both the groups. Further long term studies can be conducted to assess the impact of decline in quality of semen on the fertility potential of the young men.

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**Competing Interests**

None declared.

**References**