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Research Article

Cell Phone Usage and Semen Quality, Hospital Based Study

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Abstract: Nowadays millions of people using cell phones with increasing exposure to radiofrequency electromagnetic waves which is associated with different health hazards including possible effects on male reproduction and semen quality. The objective was to further study the effects of cell phones usage on human semen quality. The study included 262 male attending an andrology clinic for infertility evaluation. Semen analysis was performed for all participants whom have been divided into groups according to cell phone use, duration of daily use in minutes and where they keep or handle their cell phones in relation to their bodies. Semen quality parameters of the participants did not differ significantly between cell phone user and cell phone non-users. Also, semen quality parameters did not differ significantly according to daily use of cell phone in minutes or in years. Those who kept their cell phone in their trouser pockets had lower sperm motility compared to those who kept their cell phone in their waist pouch, shirt pocket or in hands, but the diffidence was statistically insignificant. The study failed to find any significant reduction of semen quality parameters in association with cell phone use. However our results support the possibility of negative effect on semen quality in association with keeping the cell phone in a trouser pocket.
Keywords: Cell phone, Men, Infertility, Semen, Electromagnetic

INTRODUCTION

Cell phones have become a vital part of everyday life including telecommunication, work activities, smart phones' applications in health, science, business and other aspects of our life. Cell phones operate using a wide range of frequency bands (400–2000 MHz) and which emits radiofrequency electromagnetic waves (RF-EMW) to nearby relay base stations or antennas. Our bodies act as antennas that absorb the radiation and convert it into alternating eddy currents. Modern advances in cell phone telecommunication systems are associated with an increase in signal frequency, which correlates with higher energy radiofrequency waves [1, 2].

Based on the international widespread use of cell phones, as it is estimated that approximately 700 million people use cellular phones on a daily basis [3, 4], there is a huge number of people who are exposed to RF-EMW emitted from cell phone that have been studied for different health effects including their effect on the male fertility and the semen quality.

A number of recent studies have suggested a possible link between cell phone use and male infertility through effects on semen quality and hormonal changes [1, 4-8]. Other animal studies demonstrated that EMW may have a broad range of damaging effects on the male reproductive functions through both thermal and non thermal effects [9, 10]. Although research into the effects of cell phone radiation on human semen quality is growing, there is no conclusive clear evidence supporting these effects up to now [1, 5]. The objective of this study is to further study the effects of cell phones usage on human semen quality.

METHODOLOGY

Hospital based cross section study was carried out from March 2012 to October 2012, including men attending the andrology clinic of Mansoura University Hospital, Egypt; for infertility evaluation. Only 450 males accepted to participate, out of whom a random sample of 301 were selected. Finally, only 262 men were included in the study who fulfilled the following criteria: non-smokers and absence of medical and surgical causes of infertility such as DM, febrile illnesses, tuberculosis, urinary tract infection, sexually transmitted diseases, a history of chemotherapy or radiotherapy, varicocele, orchitis,, undescended testes, or testicular injury. Those diseases were diagnosed by

medical past history, andrology examination by andrology specialists, fasting blood glucose, urine analysis, other investigations and Doppler examination of both testes. All participants signed a formal consent including information on the purpose and procedures of the study, information about the researchers and the confidentiality of the data. Also, the study was granted the ethical approval by Mansoura Faculty of Medicine Ethical Committee.

All study participants answered self-administered questionnaires including questions about having a cell phone, daily frequency of call (incoming and outgoing), duration of total calls per day in minutes, duration of having a cell phone in years and where they keep or handle their cell phones in relation to their bodies.

The mean age of the study subjects was 30.10 ± 6.15 and they have been divided into 4 groups according to their active cell phone usage per day; group A: no use; group B: less than 30 min/day; group C: 30–60 min/day and group D: more than 60 min/day. According the duration of having a cell phone, they have been divided into 3 groups: do not have a cell phone, having cell phone for less than 5 years and having cell phone for 5years or more. Moreover, according to the position of mobile phone in relation to the body of the mobile users, they have been divided into 4 groups: those who keep their cell phones in trouser pockets, in waist pouch, in shirt pocket or in hands.

Semen analysis

Semen samples were obtained from all participants by masturbation after an abstinence period of at least 3 days. Semen samples were processed and analyzed by computer aided semen analyzer (CASA, version 10 HTM-IVOS; Hamilton Thorne Research, Beverly, Mass). Volume, liquefaction time, pH, total sperm count per ejaculate, sperm concentration per ml, sperm motility, sperm morphology and sperm vitality were examined according to the WHO guidelines for the examination of human semen (WHO, 2010).

Statistical analysis

Statistical analysis was performed using SPSS, version 16.0, on a personal computer. Student-t test was used to statistically analyze parametric quantitative data and Man-Whitney test was used for analysis of non-parametric data. A two-tailed p value less than 0.05 was considered statistically significant. Correlation was determined between semen quality parameters; and duration of having a cell phone in years; by Pearson Correlation Coefficients.

RESULTS

The laboratory values of the semen quality parameters did not differ significantly between cell phone user and cell phone non-users (Table 1). Also, semen quality parameters did not differ significantly according to daily use of cell phone in minutes (Table 2); and there was insignificant correlation between all semen parameters and duration of cell phone usage in years (Table 3). However, volume, vitality and morphological index were lower among those using cell phone more than 60 minutes compared to other groups using cell phone less than 60 minutes, but without statistical significant difference (Table 2). Those who kept their cell phone in their trouser pockets had lower sperm motility compared to those who kept their cell phone in their waist pouch, shirt pocket or in hands, but the diffidence was statistically insignificant (Table 4).

Table 1: Means ± SD of semen quality parameters of cell phone users and non-users among 262 males attending an andrology clinic for infertility evaluation

Semen Quality Parameters	Cell phone Users No = 219	Cell phone Non-users No = 43	Test p
Volume (mL)	3.53 ±1.38	3.59 ± 1.61	0.18
Sperm Concentration ($x10^6$/mL)	35.72 ±40.19	36.27±47.80	0.35
Total Sperm Motility %	43.68±29.95	36.69±34.93	0.05
Vitality (live spermatozoa)%	56.19±27.97	56.62±33.66	0.09
WHO Morphological Index	12.64 ±10.11	12.66±11.69	0.24
Liquefaction Time (min)	27.83±7.35	27.21±7.89	0.72
pH	7.03± 0.12	7.00±0.03	0.19

Table 2: Means ± SD of semen quality parameters according to daily use of cell phone (in minutes) of 262 males attending an andrology clinic for infertility evaluation

Semen Quality Parameters	No use No =43	< 30 mints No =170	30-60 mints No =37	> 60 mints No =12	p
Volume (mL)	3.5±1.6.1	3.5±1.3	3.6±1.5	2.8±1.4	0.39
Sperm Concentration ($x10^6$/mL)	36.2 ±47.8	37.1±42.0	29.6±31.7	34.7±37.5	0.80
Total Sperm Motility %	36.6±34.9	42.4±30.3	50.1±30.1	41.1±22.3	0.29
Immotile sperm%	45.8±35.7	44.9±30.8	40.3±28.6	58.1±21.3	0.39
Vitality (live spermatozoa)%	56.6±33.6	56.1±29.0	58.8±25.2	48.1±18.1	0.74
Morphological Index	12.6±11.6	12.6±10.3	13.1±10.0	11.0±7.1	0.94
Liquefaction Time (min)	27.2±7.8	28.0±7.5	26.6±7.3	28.3±4.4	0.70
pH	7.0±0.0	7.0±0.1	7.0±0.0	7.0±0.0	0.78

Table 3: Correlation between some semen quality parameters and duration of cell phone usage in years, among 262 males attending an andrology clinic for infertility evaluation

Variable	Volume (mL)	Sperm Concentration ($x10^6$/mL)	Total Sperm Motility %	Vitality %	Morphological Index
Mobile use in years	0.079 0.20	-0.028 0.65	0.133 0.03	-0.032 0.61	0.032 0.60
Pearson Correlation Coefficients					

Table 4: Means ± SD of semen quality parameters of cell phone users (n=219) according to where they keep or handle their phones in relation to their bodies

Semen Quality Parameters	Trouser Pockets No = 123 (56.16%)	Waist Pouch No =57 (26.03%)	Shirt Pocket No =13 (5.94%)	In Hands No =26 (11.87)	p
Volume (mL)	3.4 ± 1.3	3.58±1.5	3.7±0.9	3.7±1.3	0.55
Sperm Concentration ($x10^6$/mL)	33.5±39.9	32.1±34.9	40.5±37.0	51.3±50.9	0.18
Total Sperm Motility %	41.1±29.7	44.5±30.2	46.8±34.3	52.3±27.6	0.35
Rapid progressive motile sperm%	19.6±19.2	20.9±19.2	22.9±23.5	27.1±20.5	0.32
Slow progressive motile sperm%	10.4±8.8	11.5±8.5	11.1±9.2	13.1±7.1	0.50
Non- progressive motile sperm%	9.6±8.3	8.6±6.6	9.9±8.8	10.8±6.8	0.68
Immotile sperm%	44.6±30.5	48.2±30.6	40.5±34.0	40.7±25.4	0.69
Vitality (live spermatozoa)%	57.0±28.6	51.1±28.6	62.7±27.3	60.1±22.7	0.37
WHO Morphological Index	12.1±9.7	12.9±9.9	10.3±8.3	15.6±12.3	0.34
Liquefaction Time (min)	27.6±8.6	27.3±3.9	27.6±2.5	29.6±7.9	0.61
pH	7.1±0.1	7.01±0.0	7.0±0.0	7.0±0.1	0.59

Take-Home Message

- Cell phone emits RF-EMF which could affect its user' health
- Different studies reported association between cell phone use and male infertility
- The present study did not find any significant association between cell phone use and semen quality
- Further studies are needed to study the effect of cell phone use on semen quality.

DISCUSSION

One of the most important concepts in male reproduction is that the testis requires a specialized environment to produce sperm. Recently, number of studies investigated the effect of cell phone use on semen quality in human but the results are still inconsistent without clear mechanism explaining the effects of cell phone usage on male fertility and semen quality. The present work aimed to study the association between cell phone use and semen quality parameters of males attending an andrology clinic, according to cell phone use; duration of cell phone use either daily or in years; and where they keep their cell phone in relation to their bodies.

Our results revealed no significant difference of all semen quality parameters between cell phone user and cell phone non-users. Also, the study failed to find any significant association of semen quality parameters and cell phone use either daily in minutes or in years among the study population. On the contrary, other studies reported significant decrease in semen volume, vitality and morphology with cell phone usage and

increased duration of daily exposure to cell phones among males attending infertility clinics [1, 4, 8, 11-13]. However, in spite the difference is insignificant, our study showed that those used cell phone for more than 60 minutes daily have lower semen volume, vitality and morphological index compared to those used cell phone less than 60 minutes per day.

Gutschi *et al*. [4] reported no effect of cell phone use on total sperm count and Agarwal *et al*. [1] reported that there are conflicting reports regarding correlation with sperm count suggesting the need for more research in this area; which is in agreement with our results. Moreover, our results showed that keeping cell phone in trouser pockets is associated with lower sperm motility compared to keeping cell phone in waist pouch, shirt pocket or in hands, but the diffidence was statistically insignificant. This is in agreement with Agarwal *et al*. [14] who concluded that keeping the cell phone in a trouser pocket in talk mode may negatively affect spermatozoa and impair male fertility.

Although the mechanisms of the detrimental effects of cell phone use are not yet known, some authors [2, 4, 8] hypothesized three main mechanisms explain the effects of EMW on male reproductive functions, namely, (a) an EMW-specific effect; (b) a thermal molecular effect; or (c) a combination of these two factors. These effects may lead to disruption of spermatogenesis, sperm chromatin and sperm DNA damage. There is evidence that electromagnetic exposure can cause a reduction of serum testosterone level, shrinkage of seminiferous tubules, and reduction of sperm motility and count. It is also possible that function of Leydig cells are affected by electromagnetic field[2]. Several studies on human semen suggest that an increase in ROS production due to cell phone radiation is associated with impaired semen quality [1, 8, 15, 16].

The maximal duration of daily cell phone use in our study (60 minutes) is shorter than that of other studies (more than 4 hours) [4, 8] and this may explain the statistically insignificant difference of our results. Moreover, the limitations of the present study were that we did not evaluate the effect of cell phone usage on the serum levels of the fertility-related hormones such as testosterone, Luteinizing hormone (LH), follicle stimulating hormone (FSH) and prolactin. Also, we did not study the impact of occupational and environmental exposures on the semen quality of the study population.

In conclusion, our study failed to find any significant reduction of semen quality parameters in association with cell phone use among a sample of males attending infertility clinic. However our results support the possibility of negative effect on semen quality in association with keeping the cell phone in a trouser pocket

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