ORIGINAL ARTICLE

Effect of cell phone usage and clinical correlates of male factor infertility amongst men attending infertility clinic in Benin City, Edo State Nigeria

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ABSTRACT

Background: Presently around us today in our world, there is high demand for phones and little or nothing has been said in Nigeria about the over usage and linking it to it influence on male factor infertility. **Objectives**: This study aims to determine the effect of cell phone use and clinical correlates of male factor infertility amongst couples attending infertility clinic in Benin City. **Methods**: The study is a prospective, descriptive, cross-sectional study conducted in the Department of Obstetrics and Gynaecology, Central Hospital Benin City. A cross-section of Three hundred and fifty-five (355) male partners of women who present with infertility at the gynaecological clinic were interviewed and physically examined. The Cell-phone Over-use Scale (COS) was used for mobile cell-phone addiction data which is a validated instrument with a reliability more than 90%. The semen sample was obtained by masturbation into a sterile wide-mouthed plastic container. Data was analysed using the IBM Statistical Package for Social Sciences (SPSS) and the level of significance is $p < 0.05$. **Results**: The study reported very high prevalence rate (66.5%) of male infertility, with a level of Cell-phone over usage proportion of 35.2%. It also established a significant association between cell phone over usage and prevalence of infertility. **Conclusion:** This study concluded that cell phone over usage has significant effect on clinical correlates of male factors. It also established a significant association between cell phone over usage and seminal fluid parameters. The study therefore recommends that males should desist from keeping cell phones in their trouser pockets especially in talk mode to reduce the amount of non-ionizing radiation released to their reproductive organs.

Keywords: Infertility, Electromagnetic radiation, Cell phone, phone overuse

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Introduction

In today's world cell phones have become an indispensable device. This device which now has a wide range of uses is known to emit radiofrequency (RF) electromagnetic waves (EMW) of 30 kHz - 300GHz. The range of frequencies used by mobile phones is called microwaves. These microwaves are short waves of electromagnetic energy that travel at the speed of light (300,000,000 m/s). Literatures have reported potentially harmful effects of radiofrequency electromagnetic radiation (RF-EMR) from this device which ranges from headaches, heating effects, infertility to cancer.[1-3]

These effects may be associated with the Specific Absorption Rate (SAR) which is defined as the amount of RF energy absorbed by tissues of the body; it is also a measure for estimating the emission of transmitters located near the body. The cell phones with greater SAR may cause more health effects on human body. SAR for mobile phones varies from 0.12 to 1.6 watts/kg.

However, the growing incidence of cell phone users and corresponding health effect necessitates an assessment of mobile phone effect on infertility. A number of reports has suggested a possible connection cell phone use and infertility, even though there have been limitations in some of the study design.

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Although, the concern that cell phone use might have adverse impacts on the semen quality has not been extensively addressed.[4]

The aim of this study was to evaluate the effect of cell phone usage and clinical correlates of male factor infertility amongst men attending infertility clinic in Benin City, Nigeria. This will pronounce the need for protective measures towards preventing harmful effects of EMW, on male reproductive system.

Material and Methods

This was a prospective, descriptive, cross-sectional study conducted in the Department of Obstetrics and Gynaecology, Central Hospital Benin City. This study included consecutively presenting male partners of women who presented with infertility at the gynae-ecological clinics of this hospital who consented to participation in the study and who satisfied the inclusion criteria for the study. Patients who refuse to participate in the study suffer no prejudice. Exclusion criteria was based on those who find the method of sperm collection inconvenient or objectionable; those who refuse consent or/withdraw consent; those on antibiotic treatment, patients with obvious medical conditions such as diabetes mellitus, renal failure or liver disease; Patient with HIV; patients on hormonal drugs and those previously successfully treated for infertility.

All the cases were husbands/partners of women who presented with complaint of inability to conceive after at least one year of regular unprotected coital exposure. A detailed history was taken and physical examination carried out on all cases. A data collection form specifically designed for the study was completed in the gynecological clinic to determine the possible clinically associated male factors for the infertility.

The Cell-phone Over-use Scale (COS) was used for mobile cell-phone addiction data and validated by Iranian researchers and passed the validity tests as well as reliability tests by more than 90%.[3,4] This questionnaire including 17 items and each item scoring between 1 and 5 for each item in a Likert scale. After computing the mobile cell-phone addiction score, subjects were categorized in three levels as higher 75 as over-use, 25 to 75 as normal and lower 25 as lower normal.[4,5]

The subjects were given clear oral instruction concerning semen collection and transport of semen sample to the laboratory. The sample was collected after a minimum of 72 hours abstinence, but not longer than 5 days of ejaculatory sexual abstinence. The sample was collected at home and delivered to the laboratory within one hour of collection. The sample was put in breast pocket of the man or tucked into the brassier of the woman as it is transported to the laboratory. The sample was obtained by masturbation into a sterile wide-mouthed plastic container. A drop of the sperm cells suspension was placed soon after collection on a clean grease-free slide, covered with a cover slip and examined to assess motility and a total of 100 spermatozoa were counted and the percentage of motility recorded.

A 1:10 dilution of the sperm suspension was made in physiological saline and a capillary tube was used in collecting a portion for charging into Neubauer haemocytometer. The cells in the appropriate ruled areas of the counting chamber were counted.

One drop (10 - 15µl) of 0.5% eosin was mixed with one drop of semen on a slide. After 2 minutes; the preparation was examined microscopically using x10 objective to focus the specimen and the x40 to count the percentage of viable and non-viable spermatozoa stain red.

The sample size is calculated based on local infertility prevalence rate of 30% using the formula by D.W Taylor[6]

$$N = \frac{pq}{(E/1.96)^2}$$

N = Sample size 1.96 is a constant

P = known prevalence of the disease

Q = 1-P (proportion of persons free from the condition)

E = error margin allowable

$$N = \frac{0.30 \times 0.70}{(0.05/1.96)^2}$$

$= 322$

10% attrition rate = 33

Therefore N = 322+33 = 355

The first 355 consecutively presenting couples who satisfy the inclusion criteria and who consented to participation were recruited for the study. Approval for the study was obtained from the Ethics and Research Committee of Central Hospital Benin City. All record was kept by me and securely locked up in a dedicated locker.

Statistical Analysis

All information obtained was recorded on a data collection sheet designed for the study. The data was

coded and entered into the computer using Statistical Package for Social Sciences (SPSS) version 21.0 for windows and the analysis was conducted using the same package. This will consist of initial univariate and bivariate analyses, and comparison of identified relationships and mean differences. Level of significance was set at $p<0.05$ using t-test for continuous variables and for categorical variables chi-square test with fisher exact correction where applicable.

Results

The mean age of the subjects was 34.98 years (SD 4.67) with a median age of 35.00 years and a range of 24 years to 46years. Majority (96.6%) of the respondents were 25 years and above, with 173 (48.7%) above 35 years. The mean duration of infertility was 4.50 years (SD 2.17) with a median of 4.0 years and a range of 1-12 years. The duration of infertility in 343 (96.6%) of the subjects was 2 years and above, and less than 2 years in 12 (3.4%) of the respondents. The mean duration of marriage was 4.52 years (SD 2.17) with a median of 4.1 years and a range of 1-12 years. Three hundred and forty-four (96.9%) of the subjects had a duration of marriage greater than 2 years and only in 11 (3.1%) of cases was the duration less than 2 years.

Majority (59.7%) of the subjects were of low socioeconomic status, while 95 (26.8%) of the subjects were in the middle social economic class and only 48 (13.5%) were of the high social economic class. Among the study subjects, 42 (11.8%) had primary education, 174 (49.0%) had secondary education and 139 (39.2%) attained tertiary education. Rural dwellers constituted 65(18.3%) of the study subjects while 290 (81.7%) of the subjects dwell in the urban area. 326 (91.8%) of the subjects were in a monogamous family setting while only 29 (8.2%) were polygamous family setting.

Sixty-three (17.7%) of the respondents had Primary infertility while 292 (82.3%) of the subjects had secondary infertility. Two (0.6%) of the study subjects were underweight (BMI $<18.5kg/m^2$), 99 (27.9%) were of normal weight (BMI $18.5\text{-}24.9kg/m^2$), 201(56.6%) were overweight (BMI $25\text{-}29.9kg/m^2$) while 52(14.9%) were obese (BMI $\geq 30kg/m^2$).

Figure 1 shows that among the 355 male partners, 119 (33.5%) had normozoospermia while 236 (66.5%) of the subjects had at least one form of seminal fluid abnormality giving a prevalence of male factor infertility of 66.5% in the study population.

This study reports that abnormal seminal parameters are associated with majority of the male partners (80.8%) that characteristically overused cell phones. This association is statistically significant ($p<0.001$).

Table 3 shows the mean comparison of seminal parameters based on phone overuse. Infertile men who overuse phone had significantly lower sperm count (15.02±19.99) than those who do not overuse phone (19.62±12.64; $p=0.008$). Also, men who overuse phone had lower sperm motility (52.82±15.84%) than infertile men who did not overuse phone (56.50±14.25; $p=0.026$). The volume of seminal fluid of the infertile men who overuse phone (3.42±1.12mls) was also significantly lower than those who do not overuse phone (4.06±1.21mls; $p<0.001$).

Discussion

Nigerian studies have at different times reported the attribution of couple's infertility to poor semen quality. However, most male partners attribute male infertility only to dysfunctions arising from erectile disorder, not seminal quality. This could be connected to lack of information on the subject. This study showed significant association between cell phone usage and seminal quality. This finding aligns with previous study that observing the exposed group and evaluating serum free testosterone (T), follicle stimulating hormone (FSH), luteinizing hormone (LH) and prolactin (PRL), showed significantly higher T and lower LH levels than those who did not use cell phones, revealing that cell phone usage, might adversely affect sperm quality in men.[7]

Electromagnetic radiofrequency waves emitted from cell phones could lead to oxidative stress in human semen, consequently leading to infertility. A pilot study investigated the effect of RF-EMR from cell phone during active mode on organic ejaculated human semen from normal healthy donors and infertile patients, with each sample of semen divided; one part exposed to cell phone radiation (in active mode) for an hour, and the second the not exposed. The Samples exposed to RF-EMR revealed a significant decrease in sperm motility, sperm viability and Total Antioxidant Capacity (TAC) and increase in reactive oxygen species (ROS) level. Revealing that RF-EMR emitted from cell phones may lead to oxidative stress in human semen.[8]

Kesari et.al in their study for 35 days exposed rats for 2 h/day to mobile phone frequency and found a significant decrease in antioxidant enzymes

glutathione (GSH) peroxidase and superoxide dismutase in the exposed group. A significant drop in micronuclei and significant change in sperm cell cycle of G(0)-G(1) and G(2)/M were noticed as well as increase in a generation of free radical. The authors established that there is clear overproduction of reactive oxygen species (ROS) secondary to RF-EMR exposure from commercially available cell phones that might affect the fertilizing potential of spermatozoa.[9]

Cell phones which provide a boundless ease for connection, information sourcing, entertainment and speaking has become a time consuming, inevitable device, which has left humans with no alternative to its harmful exposure. The Male Reproductive Health in Chongqing College Students (MARHCS) cohort study on "effects of cell phone use on semen quality", reported that "College students form a special population with a high percentage of digital device acceptance and use, and virtually all of them have at least one cell phone".[10]

Also drawing from the finding of Table 4, it indicated that infertile men who overused phone had significantly lower sperm count and sperm motility compared to those who did not. Also, the volume of seminal fluid of infertile men who overused phones was also significantly lower than those who did not indulge in phone overuse. Confirmed reports have previously been made on the adverse effects of time spent speaking on cell phone on sperm concentration and count. In a study by JJ Oh, et al., Twenty Sprague-dawley male rats shared into 4 groups were categorized by the intensity and exposure duration of 4G-LTE based EMF. It was observed that the exposure had a damaging effect on spermatogenesis. The longest exposed group, showed significant decrease in sperm and Leydig cell counts which indicated that prolonged use of cell phone could be unsafe for fertile men, particularly adolescent.[11] Agarwal et.al in the study of 361 men undergoing infertility evaluation, compared the mean sperm count, motility, viability and normal morphology among four different cell phone users' groups and found that, there were significantly different. The values of the sperm parameters decreased in all cell phone user groups as the duration of daily exposure to cell phone increased.[12] Also, another significant finding was the decline in the quality of semen based on the active cell phone usage time.[12]

Exposures to EMF due to time spent on calls are not the only factor of exposure, cell phone placement and nearness to the genitals is also one. Reports have shown that keeping phones in pocket of trousers could be harmful to sperm health. A study reported that men who placed cell phones in trouser pockets and belt holsters, could suffer a 30% decrease in sperm count as a result of radiation Fejes and Challis.[13] In another group (10 cm distance group) with the same duration of exposure of 4G-LTE based EMF and same energy as other groups; Oh et al. reported that this group was comparatively less affected by the EMF, which may possibly indicate that keeping a cell phone in the pocket of slacks in "(continuous access mode)" may be of adverse effect.[11]

Interestingly, those who used phones of higher generation or more sophisticated devices reported better sperm health than lower generations, owing to the decreasing EMF emanating from newer generation phones; consequently, reducing the negative effect on the sperm.[10] Contrary to the studies discussed so far, a study on 3,947 men and 186 rats, by Liu et al. asserted that EMF from mobile phones had no damaging effects on human semen parameters; however sperm motility in the animals was affected adversely.[14]

Limitation of study

Inability of the investigator to collect semen sample in the laboratory as there was no dedicated facility for that. This would have ensured that the specimen collected was indeed that of the male partner and it was strictly by masturbation.

Conclusion

This study shows quite a number of males with cell phone over usage and also reported male infertility in over two-third of the participants. It also established a significant association between cell phone over usage and seminal fluid parameters. The study therefore recommends that males should desist from keeping cell phones in their trouser pockets especially in talk mode to reduce the amount of non-ionizing radiation released to their reproductive organs.

List of abbreviations

MARHCS- The Male Reproductive Health in Chongqing College Students
RF-EMW- Radiofrequency Electromagnetic Waves
SAR- Specific Absorption Rate.

Table 1: Socio-demographic characteristics of study population

	N	%
Age group (yrs)		
<25	12	3.4
25 – 35	170	47.9
>35	173	48.7
Mean age = 34.98 (SD 4.67)		
Duration of Infertility (yrs.)		
< 2	12	3.4
≥ 2	343	96.6
Mean duration = 4.50 (SD 2.17)		
Duration of Marriage		
Less than 2yrs	11	3.1
2yrs and above	344	96.9
Mean duration = 4.52 (2.17)		
Social Status		
Low	212	59.7
Middle	95	26.8
High	48	13.5
Educational Level		
No formal education	0	0
Primary	42	11.8
Secondary	174	49
Tertiary	139	39.2
Location of residence		
Rural	65	18.3
Urban	290	81.7
Marital Status		
Monogamy	326	91.8
Polygamy	29	8.2
BMI		
Underweight	2	0.6
Normal weight	99	27.9
Overweight	201	56.6
Obesity	53	14.9
Subset of Infertility		
Primary	63	17.7
Secondary	292	82.3

Table 2: Association of phone usage and seminal parameter

	Phone overuse			
	Yes	**No**	**χ^2**	**P**
Normal	24(19.2)	95(41.3)	17.757	0.000
Abnormal	101(80.8)	135(58.7)		
Total	125(100.0)	230(100.0)		

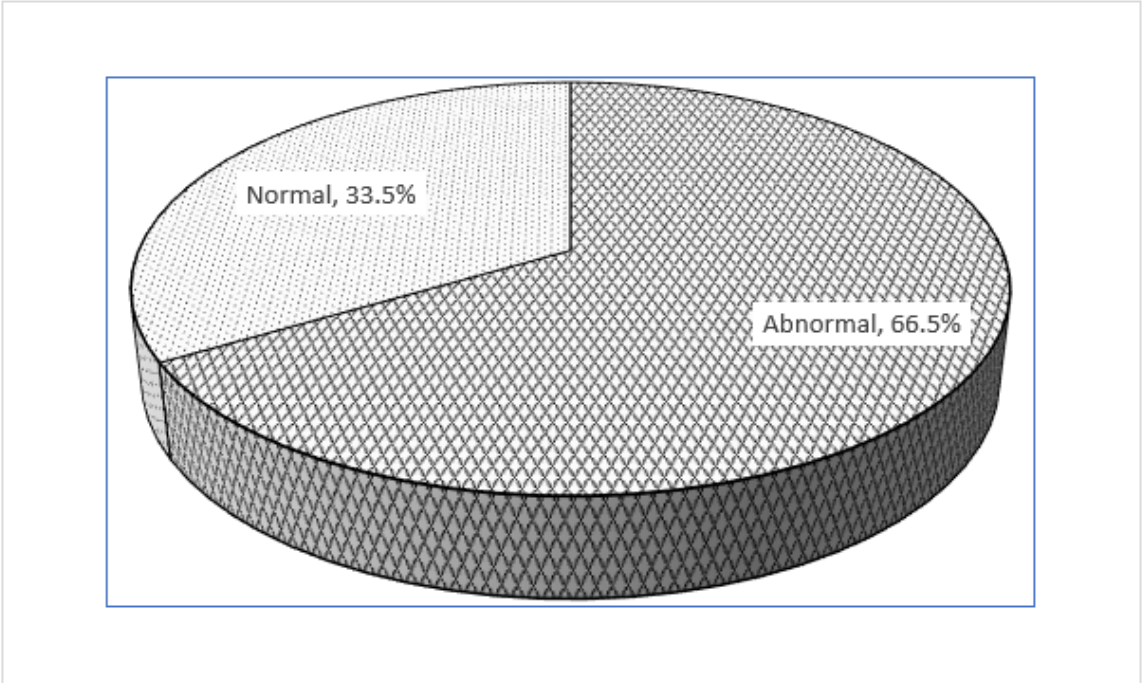

Figure 1: Prevalence of male Infertility

Table 3: Mean comparison of seminal parameters based on phone overuse

	Phone Overuse			
	Yes (n=125)	**No (n=230)**	**T**	**P**
Count (Million sperm/mls)	15.02±19.99	19.62±12.64	2.650	0.008
Motility (%)	52.82±15.84	56.50±14.25	2.233	0.026
Volume (mls)	3.42±1.12	4.06±1.21	4.884	<0.001

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