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Original Research Article

Does use of mobile phone affect human semen profile?

Jayram[1], Mukesh Kumar[2]*, M. S. Srinivasa[3]

[1]Department of Zoology, R. D. Girls College, Bharatpur, Rajasthan, India
[2]Department of Zoology, M.S.J. Govt. P. G. College, Bharatpur, Rajasthan, India
[3]International Institute for Assisted Reproductive Technology and Research (IIARTRC), VGK-TRC Trust, Mysuru, Karnataka, India

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***Correspondence:**
Dr. Mukesh Kumar,
E-mail: prof.mukeshkumar@rediffmail.com

ABSTRACT

Background: Mobile telephony is not very old technology. It functions based on electro-magnetic radiation (EMR). Mobile users are rapidly increasing every day and this technology is advancing rapidly. Scientists have demonstrated that EMR affects the human health and reproductive system too. Some other scientists revealed that mobile telephony does not affect human health. Our preliminary studies have shown that mobile telephony has some correlation with human semen profile in the exposure dependent manner. Therefore, this study was planned in male human volunteers to reassess the possible effects of mobile telephony on human semen profile in our infertility centre.
Methods: 74- human male volunteers consented and included in our research study. Their mobile phone placing, use hour/day was recorded and these volunteers were placed in three Groups- A, B and C (exposure of mobile telephony was 3-4 hrs, 5-6 hrs and 7-8 hrs respectively and approximately).
Results: Semen analysis was done using WHO method manual in our infertility research centre, Bangaluru, India. Semen analysis shows that decline in sperm density, motility (quantitatively and qualitatively) and enhanced percentage of abnormal sperm. It appears to be associated with duration exposure dependant as we found in our earlier study.
Conclusions: In conclusion, we may say that decline in sperm density, motility and enhanced percentage of sperm abnormalities may be associated with the use of mobile telephony along with other factors. Further research studies are needed to ascertain the possible effects of mobile telephony on human male reproductive health.

Keywords: Infertility research, Mobile telephony, Semen profile

INTRODUCTION

Male infertility refers to the inability of a man to impregnate his partner despite regular unprotected intercourse during fertile period of women over a prolonged period, typically one year or more.[1,2] Male Infertility is a growing global concern, affecting millions of couples seeking to conceive.[3] Declining sperm density, motility and morphology serious problem world over.[4] Among the various causes of male infertility, environmental and lifestyle factors have gained increasing attention in recent years.[5] Mobile telephony is one of such factor.[6-7] Mobile phones emit radio-frequency electro-magnetic radiation (RF-EMR), which has been suggested to influence human male general health as well as reproductive health.[8,9]

Recent researches being done by various scientists revealed that exposure of mobile telephony (RF-EMR) may be causative factor of headache, forgetfulness, sleep disturbances, irritability, depressive tendencies, feeling of discomfort, difficulties in concentration, memory loss, fatigue, burning near ear, decreased systolic blood pressure, diastolic blood pressure and heart rate while increased carelessness, forgetfulness and risk of brain cancer in human.[10-13]

Rapidly increasing usage of mobile phone has led to concerns about its potential biological effects, particularly regarding reproductive health.[6,7] Mobile phones emit non-ionizing RF-EMR, which can penetrate human tissues and generate heat.[14] Prolonged exposure to RF-EMR, especially when mobile phones are carried close to the body, such as in trouser pockets, may adversely affect the male reproductive system.[6]

Research studies being done during this decade showed that exposure of 2.45 GHz microwave/ 900MHz/1800MHz/2.4GHz Wi-Fi radiation affects sperm count, sperm viability, sperm motility and increases percentage of abnormal sperm (head, mid piece, and tail defect) in animals.[15-20]

Recent research studies have highlighted that use of mobile phone [EMR 900 MHz / 1800 MHz / Wi-Fi 2.45 GHz RFR] decreased sperm rapid progressive motility, slowing of progressive motility, total sperm motility, decline sperm count, sperm density, semen volume, sperm concentration, sperm viability, and increase the percentage of non- motile sperm, morphological abnormal sperm cells in semen sample.[21-26]

Contrary to the above-mentioned studies some other scientists showed that use of mobile telephony (electro-magnetic radiation) did not affect sperm count, sperm normal morphology, sperm motility, sperm viability, and sperm concentration in rats.[27,28]

Research findings of human studies showed that exposure of mobile telephony (electro-magnetic radiation) did not affect sperm count, sperm concentration, semen volume, sperm progressive motility, sperm motility, sperm viability and morphology significantly.[29-31]

Very interesting study being done by Wdowiak et al, 2018 showed that of exposure to 43 KHz RFR increased percentages of sperm forward movement in103 fertile healthy male.[32]

From above cited research studies, it is very conspicuous that mobile telephony is not very old phenomenon. Important research studies being done so far reveal that further research work is needed in order to reach the final conclusion whether it does affect the human health/reproductive health or not. If mobile telephony does have adverse effect on human health, then it is going to be very serious problem in future (as we cannot do away with technology). Therefore, solid conclusions should be drawn about the safety of mobile telephony based on scientific research studies. Our group has done research studies (passé-1) in 82 human male volunteers recently shows that decline in sperm density, motility and rise in percentage of different kind/type abnormal sperm. It appears to be related to duration of mobile usage along with other environmental factors (Jayram, Kumar and Srinivasa communicated).

Here we further extended our study (phase-2) in 74 human male volunteers who were mobile users for different duration/ day (approximately), assessing their semen profile in order to assess their fertility/ sub fertility/ infertility. As it requires, huge number of male volunteers to reach or derive conclusion along with some human in vitro studies. Hence, this study being planned in human in order to investigate the effect of mobile telephony on human semen profile.

METHODS

Study type

Descriptive design was used in this study.

Study place (hospital)

Caree test tube baby center, Basaveshwar Nagar, Bengaluru, Karnataka, India.

Study period

The study period was from January, 2024 to December, 2024.

Selection criteria of human volunteers

A total 74-human volunteers (out of several) who were mobile users for last many years attending our Infertility Centre were chosen with their consent. Purpose and objectives of the study were explained to all volunteers and their written consent was taken for this study.

Entire study comprised of volunteers of 3 groups in following ways based on exposure of mobile phone/ day in a following manner:

Group A- This group had 23 male volunteers (age 33.2± 4.8 years) having exposure of mobile phone 3-4 hrs/day approximately.

Group B- This group had 33 male volunteers (age 34.2± 5.6 years) had exposure of mobile phone for 5-6 hrs/day (using hours).

Group C- This group had 18 male volunteers (age 34± 8.15 years) had exposure of mobile phone for 7-8 hrs/day (using hours).

Statistical analysis

Statistical analysis was done using standard deviation formula of obtained data.[33]

Standard deviation

$$\sigma = \sqrt{\left(\frac{\Sigma (x_i - \mu)}{N}\right)}$$

Where σ = Population standard deviation, N=Size of Population, x_i= Each value from the population, μ =The Population Mean

Data being presented by bar diagram.

Recording of personal details of human volunteers

Before initiating this research investigation, following personal details were recorded: profession of volunteers, cell phone placing (shirts pocket/trouser pocket), mobile phone use hours/day (approximately), total number of years of mobile phone use and abstinence period.

Semen collection

Three semen samples of each individual/volunteer (3 to 7 days abstinence period between two semen collections) were collected by masturbation in infertility clinic and processed for semen analysis.

Semen analysis

Semen analysis was done following WHO method manual sixth edition (WHO, 2021)34 and following parameters were done: abstinence period, semen liquefaction time, semen colour, semen volume, semen viscosity, sperm density, sperm motility (quality/quantity) and sperm morphology.

RESULTS

Profession of volunteers

Human male volunteers were from different profession like business establishments, Govt. employees, contractor, advocate, supervisor, automobile worker, IT, driver, salesman, marketing and company/ factory worker.

Brand of mobile phone

Human volunteers used different brand of mobile phone like Vivo, Oppo, Redmi, Samsung, Realme, i phone, One Plus and Nokia keypad. It is obvious that all the included volunteers cannot have similar brand of mobile phones.

Cell phone placing

Major categories of mobile placement were trouser pocket and shirt's pocket. 56.07% mobile users kept mobile in trouser pocket while 43.93% mobile user kept in shirt's pocket. Placement of mobile phone was not very constant and fixed; this data was based on in general habit of mobile keeping.

Abstinence period

Semen samples were collected from the volunteers using 3-7 days abstinence period (as reported by them).

Semen liquefaction time

Liquefaction time of semen samples of different volunteers fell within the normal time period (20-30 min.) during our study period.

Semen colour

The normal colour of different samples from all volunteers was observed throughout the entire study period.

Semen volume

Semen volume of volunteers was within the normal ranged from 1.5- 3.0 ml.

Semen viscosity

No significant changes were observed in semen viscosity during entire study period.

Sperm density

A decline in sperm density was observed in all three groups of our study and further decrease was also noticed as exposure of mobile phone enhanced as evidenced in group A (19.78±12.09), group B (18.27±12.19) and group C (17±8.07). As all three groups were oligospermic. Lowest sperm density was observed in a longest mobile exposed group C (Figure 1).

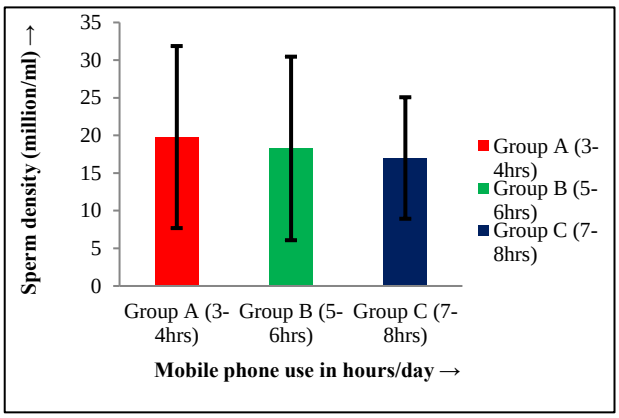

Figure 1: Sperm density showing declining trends in all groups.

Sperm motility (%)

A decrease in sperm motility (%) was observed in all three mobile user groups. A decreasing trend was increased as exposure period enhanced (Figure 2).

Rapid progressive motility (%)

Percentage of rapid progressive movement of sperm was further decreased as use of mobile phone enhanced (Figure 3).

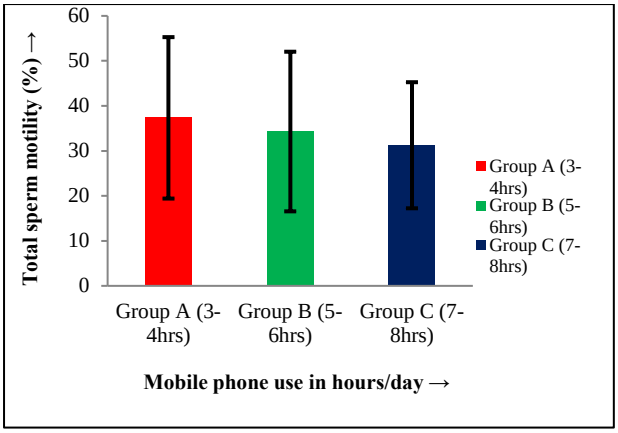

Figure 2: Sperm motility depleted in all three groups and it was associated with exposure duration.

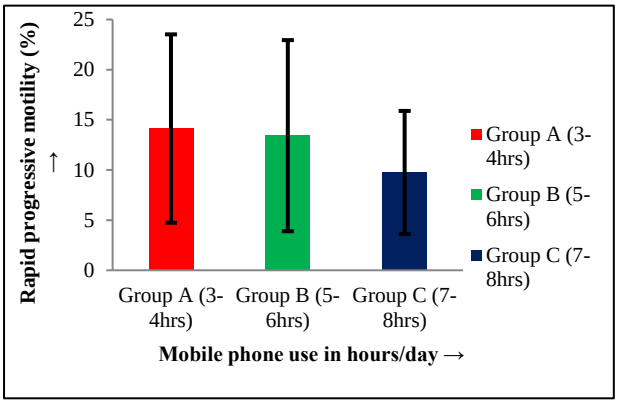

Figure 3: Declining pattern in rapid progressive sperm movement and was associated with exposure duration.

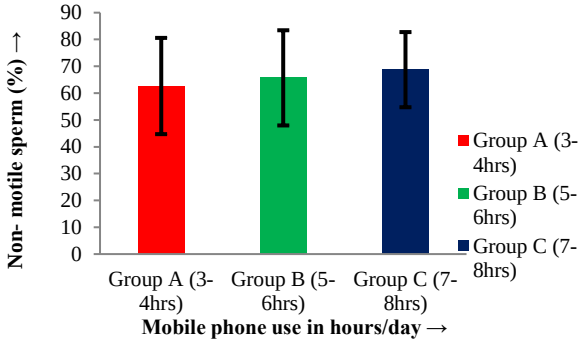

Figure 4: Percentage of non-motile sperm elevated which was associated with exposure of mobile telephony.

Non- motile sperm (%)

Percentage of non- motile sperm increased in all three groups of our study. Highest increase in non-motile sperm was witnessed in the semen profile of volunteers of group C where they used mobile phone 7-8 hrs approximately (Figure 4).

Sperm morphology

Normal sperm (%)

Percentage of normal sperm declined in all male volunteers of three groups of mobile users. It was lowest in group C (Figure 5).

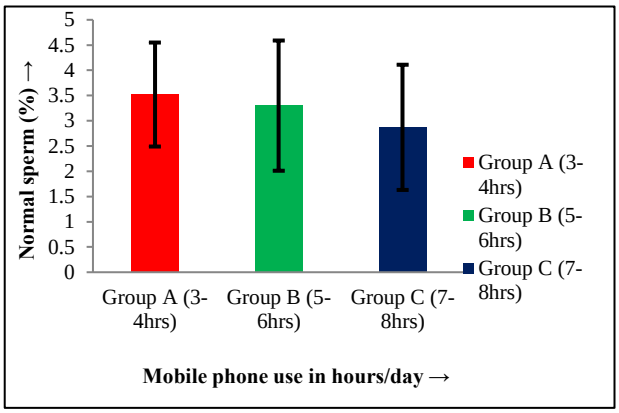

Figure 5: Downfall in percentage of normal sperm with enhanced exposure time.

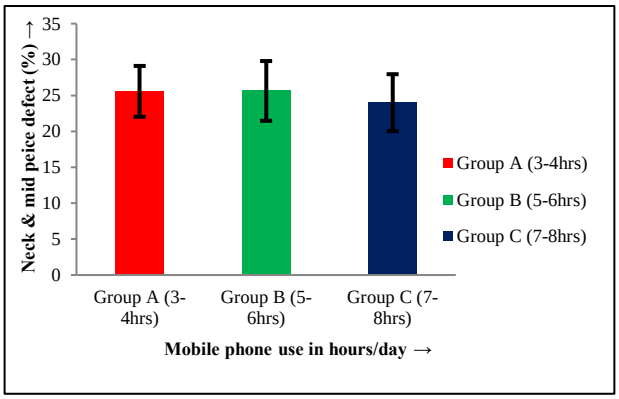

Figure 6: Percentage of sperm neck and mid piece defects in all exposure groups.

Sperm head defects (%)

The percentage of sperm head defects was observed (57.04±4.57 in Group A, 56.9±4.86 in Group B, and 58.62±3.58 in Group C). The highest percentage of head defects of sperm was seen in Group C, where mobile phones were used for approximately 7-8 hours daily.

Defects in neck and mid piece of spermatozoa (%)

Deformities in neck and mid piece of sperm were clearly observable and it ranged 24-26% (Figure 6).

Sperm tail defects

The enhanced number of sperm tail defects was also observed (Figure 7-D).

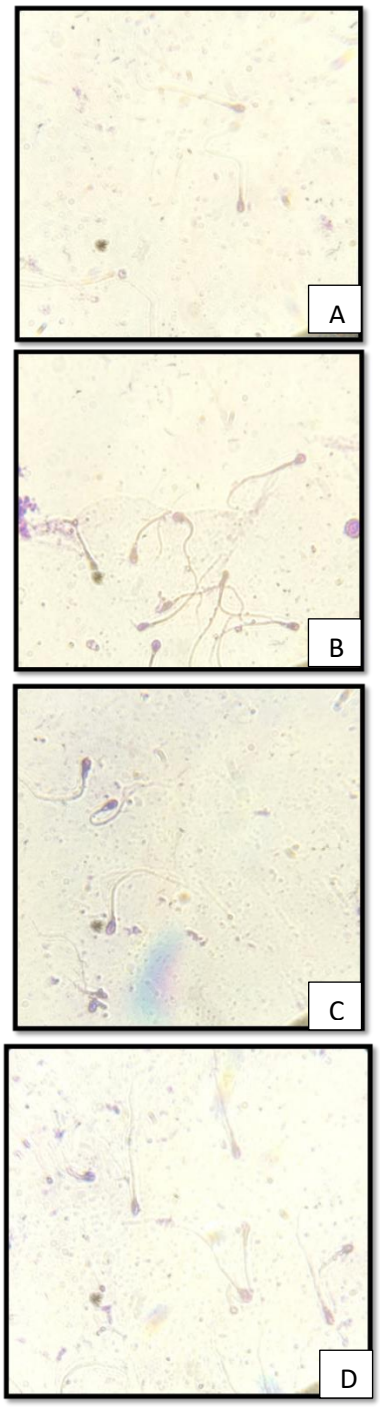

Figure 7: (A) Normal spermatozoa; (B) Sperms with head defects; (C) Neck and mid piece defects; (D) Sperm with tail defects.

DISCUSSION

This human research study (phase-2) was designed to investigate (reconfirm) the possible effect of mobile telephony on human semen profile (as our earlier phase-1study in human volunteers we found decline in sperm profile). Our infertility clinic has regular visitors of male/female patients for infertility problems. Human male is examined first when infertility problem being faced by the couples as it is easier and cheap. Recent studies being done in animals and human show that electro- magnetic radiation (EMR) affects male reproductive system.[22,23,35-38]

Contrary to this, some published research studies also showed that electro-magnetic radiation does not affect male reproductive health.[28,33]

Our research study shows that volunteers of three groups (A, B and C) were (all) oligospermic. These human males were mobile users of 3-4 hrs (Group A), 5-6 hrs (Group B) and 7-8 hrs (Group C) respectively. This exposure period was approximately (as reported by them) colour, semen volume and viscosity were well within the range. Other scientists have also reported that semen colour, volume and viscosity remain unaffected.[30] It is directly reflection of normal testosterone level and accessory sex glands.

All human volunteers of this study were oligospermic and decrease in sperm was associated with increased duration of mobile exposure. Other research investigators also revealed that long duration of exposure affects the sperm density.[7,19,38]

Abnormal percentage of sperm in semen sample also greatly increased as it seems to be associated with enhance exposure of mobile telephony which affects the fertilizing ability of spermatozoa that in-turn affects male fertility. This finding is supported by other researchers.[6,19,39,40]

Sperm motility is very important factor for fertilization process. Some research findings in animals and human showed that exposure of EMR affects the sperm motility qualitatively and quantitatively.[7,20,37,38] In our research investigation we also found that sperm motility decreased and it was probably associated with the exposure period which may affect fertilization process or male fertility.

This research study had a long-term objective to ascertain the effect of mobile telephony on male reproductive health and therefore number of volunteers should be in large number.

Some in vitro studies of human volunteers are also needed to investigate the direct effect of EMR (mobile telephony). In vitro studies have shown that exposure of mobile affects sperm motility.[29,23] Our in vitro studies are in process to ascertain the effect of mobile phone on sperm motility.

CONCLUSION

In conclusion, it appears that use of mobile phone affects the sperm density and sperm motility along with sperm morphology which has been observed by other researchers, it appears to be associated with close proximity of mobile phone.

Further research is needed to ascertain the effect of mobile telephony on human health especially reproductive health,

if it is affecting then it is going to be a serious and major problem in the future because use of mobile phones and coverage area of mobile tower are increasing every day.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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