

DOI: <https://dx.doi.org/10.18203/2320-1770.ijrcog20252320>

Original Research Article

Human semen profile and mobile telephony: an original research study

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Received: 17 April 2025

Revised: 15 June 2025

Accepted: 03 July 2025

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ABSTRACT

Background: Mobile telephony is recent phenomenon; it functions based on electro-magnetic radiation (EMR). It has revolutionized the telephonic communication system. Major population of world is using mobile telephony with android mobile handsets. Mobile users are rapidly increasing every day. Researchers show that Electro- Magnetic Radiation affects the human health and causes tumour, cancer and other diseases. This has also been reported that mobile telephony affects the reproductive health too. But some researchers claimed that mobile telephony does not affect human health. Therefore, this study was planned in male human volunteers to assess the possible effects of mobile telephony on semen profile.

Methods: Eighty-two human male volunteers consented for our research study. Their mobile phone placing, using hour/day was recorded and these volunteers were placed in three Groups A, B and C (exposure of mobile telephony was 3-4 hours, 5-6 hours and 7-8 hours respectively and approximately).

Results: Semen analysis was done using WHO method manual in our infertility research centre, Bengaluru, India. Semen analysis of these volunteers 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.

Conclusions: In conclusion, we may say that sub-fertility in human male 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: Mobile telephony, Human semen profile, Electro-magnetic radiation

INTRODUCTION

Male infertility refers to the inability of a man to impregnate his partner despite regular unprotected intercourse over a prolonged period, typically one year or more.^{1,2} Infertility is a growing global concern, affecting millions of couples seeking to conceive.³

Among the various causes of male infertility, environmental and lifestyle factors have gained increasing attention in recent years.⁴ One such factor under scrutiny is mobile telephony.⁵⁻⁷ 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.⁷⁻⁹ Research studies being done by various researchers suggested that exposure of mobile telephony RF-EMR caused 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.⁸⁻¹³ The exponential rise in mobile phone usage has led to concerns about its potential biological effects, particularly regarding reproductive health.⁵⁻⁷ 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.⁵ In last decade use of mobile phones increased rapidly. Research findings of this decade revealed that exposure of 2.45 GHz microwave/ 900 MHz/1800 MHz/2.4 GHz Wi-Fi radiation decreased sperm count, sperm viability, sperm motility and increases percentage of abnormal sperm (head, mid piece and tail defects) in animals.¹⁵⁻²⁰

Recent studies have highlighted that exposure 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.^{3,7,21-26}

Contrary to the above mentioned studies some other researchers revealed that exposure of mobile telephony did not affect sperm count, sperm normal morphology, sperm motility, sperm viability and sperm concentration, in rats.^{16,18,27,28} Research findings in human semen profile also suggested 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.²⁹⁻³² Whereas Wdowiak et al, showed that of exposure to 43 KHz RFR increased percentages of sperm progressive motility in 103 fertile healthy male.³³

From above cited literature, it is very clear that mobile telephony is not very old technology. 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. 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

Caree Test Tube Baby Center, Basaveshwar Nagar, Bengaluru, Karnataka (India).

Study period

The study period was from January, 2023 to December, 2023.

Selection criteria of human male volunteers

Eighty-two human volunteers (out of several) who are 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 consent was taken for this study. Entire study comprised of volunteers of 3 groups in following ways.

Group A

This group had 31 male volunteers (age 34.5±5.8 years) having exposure of mobile phone 3-4 hours/day approximately.

Group B

This group had 29 male volunteers (age 32.6±3.8 years) had exposure of mobile phone for 5-6 hours/day (using hours).

Group C

These 22 male volunteers (age 33.6±5.4 years) had exposure of mobile phone for 7-8 hours/day (using hours).

Ethical approval

Not required.

Statistical analysis

Statistical analysis was done using standard deviation formula of obtained data.³⁴

Standard deviation

$$\sigma = \sqrt{((\sum (x_i - \mu))/N))}$$

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)³⁵ and following parameters were done: Abstinence period, Semen liquefaction time, Semen colour, Semen volume, Semen viscosity, Sperm density and Sperm motility (Quality/Quantity).

RESULTS

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

Normal colour of different samples of all volunteer was observed during entire study period (normal colour of semen sample is grey- opaque).

Semen volume

Semen volume of volunteers was within the normal range 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 (17.45 ± 9.03), group B (15.27 ± 9.26) and group C (13.8 ± 6.79). As all three groups were oligospermic.

Lowest sperm density was observed in a longest mobile exposed group C (Figure 1).

Sperm motility (%)

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

Rapid progressive motility (%)

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

Non-motile sperm (%)

The percentage of non-motile sperm was observed in Group A (62.64 ± 16.76), Group B (66.17 ± 15.04) and Group C (71.8 ± 15.8). Highest increase in non-motile sperm was seen in the semen sample of volunteers of group C where they used mobile phone 7-8 hours/day 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).

Sperm head defects (%)

Sperm head defects were greatly seen in semen samples of all volunteer ranged 50-65% and highest observed in Group C where exposure duration of mobile was 7-8 hours approximately (Figure 6).

Defect in neck and mid piece of spermatozoa (%)

The percentage of defects in sperm neck and mid piece was observed to be 23.28 ± 3.65 in Group A, 24.36 ± 3.78 in Group B and 21 ± 3.55 in Group C (Figure 4).

Sperm tail defects

Tail defects were also evident in all semen samples being analyzed (Figure 7D).

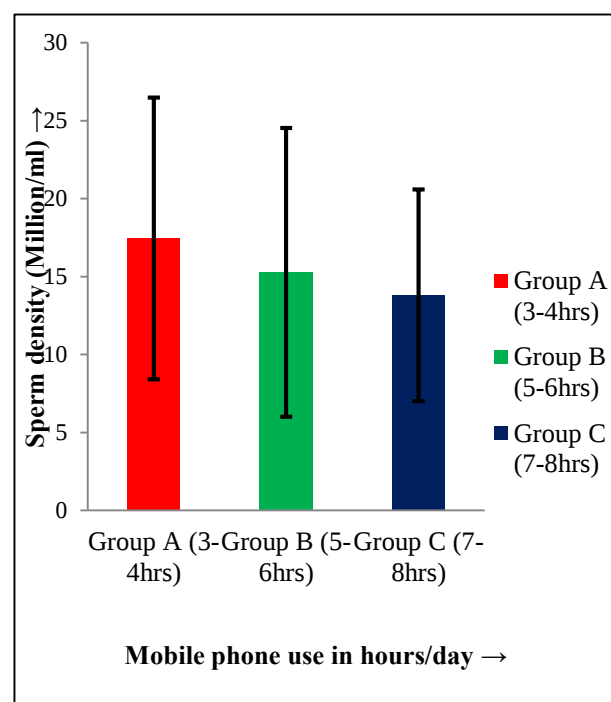


Figure 1: Sperm density showing declining trend.

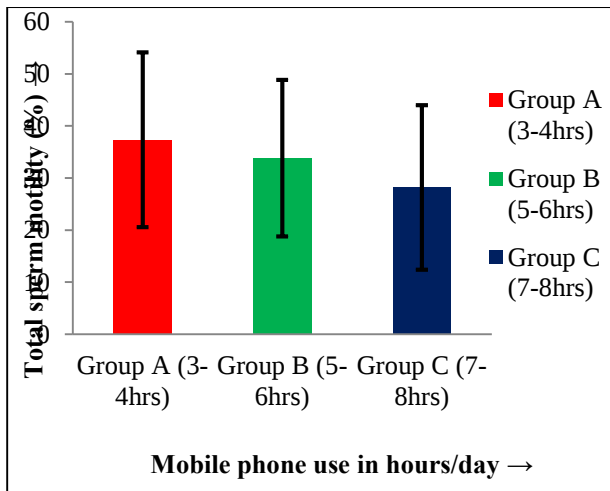


Figure 2: Sperm motility declined in all three groups and it was associated with exposure duration.

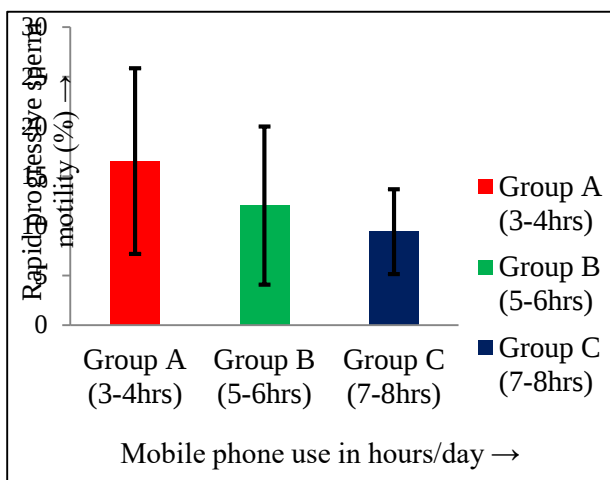


Figure 3: Rapid progressive movement of sperm declined and it seems to be associated with exposure of mobile telephony.

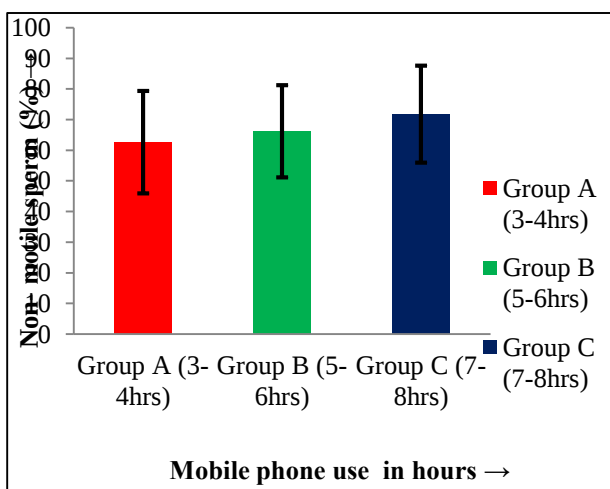


Figure 4: Percentage of non-motile sperm enhanced which may be associated with exposure of mobile telephony.

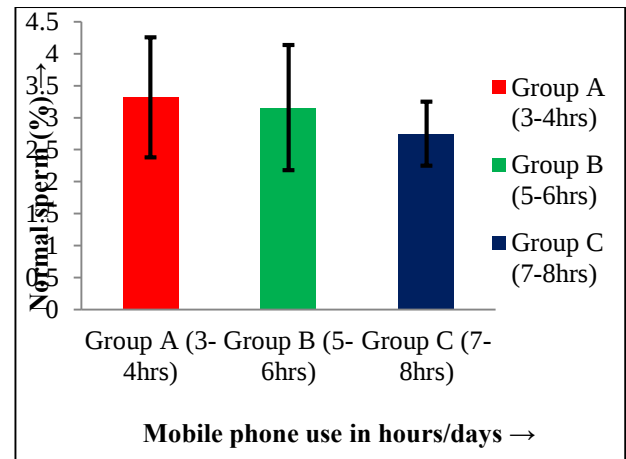


Figure 5: Percentage of normal sperm.

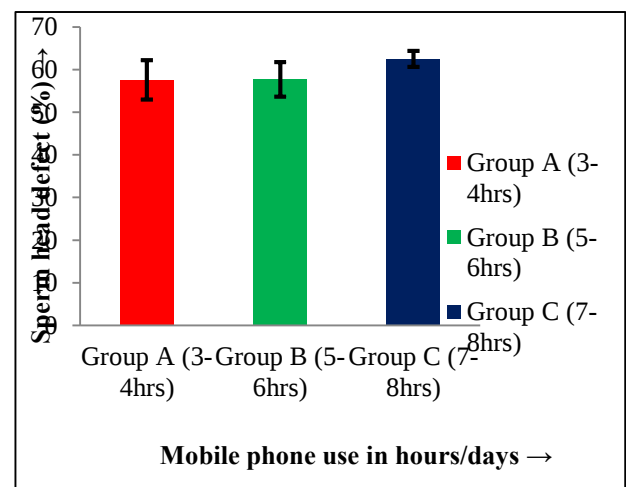


Figure 6: Sperm head defect in exposed groups.

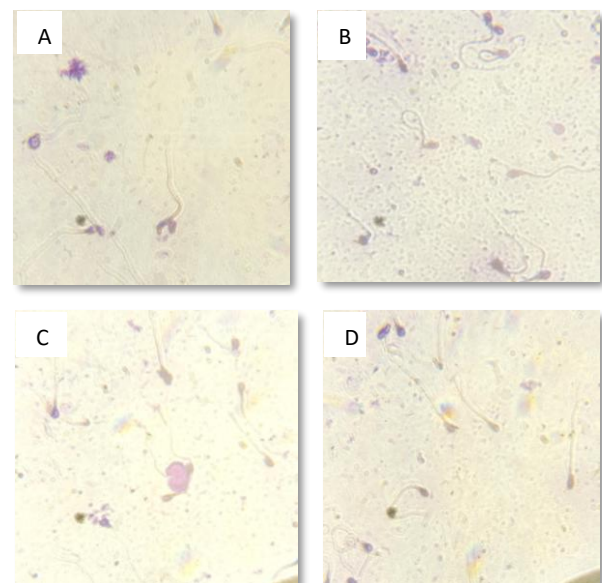


Figure 7: (A) Sperms with head defects. (B) Normal spermatozoa. (C) Head defects and presence of immature germ cells. (D) Sperm with tail defects.

DISCUSSION

This study was designed to investigate the possible effect of mobile telephony on human semen profile. Our infertility clinic has regular visitors of male/female patients for infertility problems. Male patients are 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) affect reproductive system.^{7,22,23,26,36-37}

But on the other hand, some research studies also reveal that electro-magnetic radiation does not affect reproductive health.^{28,33,38} The study shows that volunteers of three groups (A, B and C) were (all) oligospermic. These volunteers were mobile users of 3-4 hours (Group A), 5-6 hours (Group B) and 7-8 hours (Group C) respectively. This exposure period was in approximately (as reported by them) colour, semen volume and viscosity were well within the range. Other researchers also reported that semen colour, volume and viscosity remain unaffected.³⁰ It is directly reflection of normal testosterone level and accessory sex glands.

All male volunteers of this study were oligospermic and decrease in sperm density was associated with enhanced duration of mobile exposure. Other research investigators also revealed that long duration of exposure affect the sperm density.^{7,19,22,37} Percentage of abnormal sperm in semen sample also greatly enhanced 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 studies show in animals and human exposure of EMR affects the sperm motility qualitatively and quantitatively.^{7,20,23,36,37} In our study we also found that sperm motility declined and it was probably associated with the exposure period which may affect fertilization process or male fertility.

This study has 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). These studies are underway by our group.

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.

Further studies are needed to ascertain the effects of mobile telephony on human health especially reproductive health, if it is affecting then it is going to be major problem

in future because use of mobile phones and coverage of mobile tower are increasing every day.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. World Health Organization. The influence of varicocele on parameters of fertility in a large group of men presenting to infertility clinics. *Fert Steri.* 1992;57:1289-93.
2. ESHRE Guidelines to the prevalence, diagnosis, treatment and management of infertility. The ESHRE Capri Workshop. *Human Reproduction.* 1996;11:1176-807.
3. Sciorio R, Tramontano L, Esteves SC. Effects of mobile phone radiofrequency radiation on sperm quality. *Zygote.* 2021; 1-10.
4. Kumar S, Murarka S, Mishra VV, Gautam AK. Environmental & lifestyle factors in deterioration of male reproductive health. *Indian J Med Res.* 2014;7:29-35.
5. Chalabi SSA, Wattar YTA. Effect of mobile phone usage on semen analysis in infertile men. *Tikrit Journal of pharmaceutical Sciences* 2011;7(1):1-6.
6. Gutschi T, Mohamad Al-Ali B, Shamloul R, Pummer K, Trummer H. Impact of cell phone use on men's semen parameters. *Andrologia.* 2011;43:312-6.
7. Ding SS, Sun P, Tian H, Huo YW, Wang LR, Han Y. Association between daily exposure to electromagnetic radiation from 4G Smartphone and 2.45-GHz Wi-Fi and oxidative damage to semen of males attending a genetics clinic: A primary study. *Int J Clin Exp Med.* 2018;11(3):2821-30.
8. Thomée S, Harenstam A, Hagberg M. Mobile phone use and stress, sleep disturbances and symptoms of depression among young adults - a prospective cohort study. *BMC Public Health.* 2011;11(66):1-11.
9. Amiri F, Moradinazar M, Moludi J, Pasdar Y, Najaf F, Shakiba E. The association between self-reported mobile phone usage with blood pressure and heart rate: evidence from a cross-sectional study. *BMC Public Health.* 2022;22:1-10.
10. Alazawi SA. Mobile Phone Base Stations Health Effects. *Diyala Journal of Medicine* 2011;1(1):44-52.
11. Hamada AJ, Singh A, Agarwal A. Cell phone and their impact on male fertility. Fact or Fiction. *The Open Reprod Sci J.* 2011;5:125-37.
12. Kivrak EG, Yurt KK, Kaplan AA, Alkan I, Altun G. Effects of electromagnetic fields exposure on the antioxidant defense system. *J Micros Ultrastruc.* 2017;5:167-76.
13. Belpomme D, Hardell L, Belyaev I, Burgio E, Carpenter DO. Thermal and non-thermal health effects of low intensity non-ionizing radiation: An international perspective. *Environ Poll.* 2018;242:643-58.

14. Dharni AK. Study of electromagnetic radiation pollution in an Indian city. *Environ Monit Assess.* 2012;184:6507–12.
15. Dasdag S, Tas M, Akdag MZ, Yegin K. Effect of long-term Exposure of 2.4 GHz radio-frequency radiation emitted from Wi-Fi equipment on testes function. *Electromagn Biol Med.* 2015;34(1):37-42.
16. Mahmoudi R, Mortazavi SM J, Safari S, Nikseresht M, Mozdarani H, Jafari M. Effects of microwave electromagnetic radiations emitted from common Wi-Fi routers on rats' sperm count and motility. *Int J Radiat Res.* 2015;13(4): 363-8.
17. Bahaodini A, Owjifard M, Tamadon A, Jafari SM. Low frequency electromagnetic fields long-term exposure effects on testicular histology, sperm quality and testosterone levels of male rats. *Asian Pacific J Reprod.* 2015;4(3):195-200.
18. Oyewopo AO, Olaniyi SK, Oyewopo CI, Jimoh AT. Cell Phone Alters oxidative Status and Impairs testicular function of Male Wistar Rats. *J Reprod Endocrinol Infert.* 2017;2:1-5.
19. Ali BMH. Study the electromagnetic radiation effects on testicular function of male rats by biochemical and histopathological. *Eurasian J BioSci.* 2020;14:3869-73.
20. Ghasemiannejadjahromi F, Raji A, Maleki M, Mirshokraei P, Kafaerazavi M. Investing the effect of 2100 MHz frequency electromagnetic field on the male rat reproductive system. *Research Square.* 2022;1:6-13.
21. Zilberlicht A, Megnazi ZW, Sheinfeld Y, Grach B, Baratz SL, Dimfeld M. Habits of cell phone usage and sperm quality—does it warrant attention. *Reproductive BioMed.* 2015;31:421-26.
22. Zhang G, Yan H, Chen Q, Liu K, Ling X, Sun L. Effects of cell phone use on semen parameters: Results from the MARHCS cohort study in chongqing, china. *Environ Int.* 2016;91:116-21.
23. Parsanezhad ME, Mortazavi SMJ, Doohandeh T, Jahromi BN, Mozdarani N, Zarei A. Exposure to radiofrequency radiation emitted from mobile phone jammers adversely affects the quality of human sperm. *Int J Radiat Res* 2017;15(1):63-70.
24. El-Hamd MA, Aboeldahab S. Cell phone and male Infertility: An update. *Research Gate* 2018;156:6043.
25. Azab AE, Kholat AM, Ebrahim SA, Albasha MO. Electromagnetic fields and its harmful effects on the male reproductive system. *Biosci Bioengineering J.* 2018;4(1):1-13.
26. Darvish L, Amraee A, Amjadi MA, Kashani ZA, Ghazanfarpour M, Roozbeh N. The impact of radiofrequency waves on male infertility: a systematic review. *Shiraz E-Med J.* 2021;22(3):1-9.
27. Mailankot M, Kunnatt AP, Jayalekshmi H, Koduru B, Valsalan R. Radio-frequency electromagnetic radiation (RF-EMR) from GSM (0.9/1.8 GHz) mobile phones induces oxidative stress and reduces sperm motility in rats. *Clinics.* 2009;64(6):561-5.
28. Tas M, Dasdag S, Akdag MZ, Cirit U, Yegin K, Seker U. Long-term effects of 900 MHz radiofrequency radiation emitted from mobile phone on testicular tissue and epididymal semen quality. *Electromagnetic Biology and Med.* 2013;33(3):216-22.
29. Gorpichenko I, Nikitin O, Banyra O, Shulyak A. The influence of direct mobile phone radiation on sperm quality. *Cent European J Urol.* 2012;67:65-71.
30. Yildirim ME, Kaynar M, Badem H, Cavis M, Karatas OF, Cimentepe E. What is harmful for male fertility: Cell phone or the wireless internet. *Kaohsiung J Med Sci.* 2015;31:480-84.
31. Munasinghe Dal, Weerasooriya MKB, Liyanage JA, Wakkumbura HP. Effect of carrying cell phones in trouser pockets, on semen parameters. *JIRMEPS.* 2017;12(2): 33-8.
32. Syam HH, Effendi JS, Madjid TH, Djuwantono T, Permadi W, Irsyad B. Does mobile phone radiation affect sperm quality. *Open Access Library J.* 2017;4:1-9.
33. Wdowiak A, Mazurek A, Wdowiak A, Bozar A. Low frequency Electromagnetic waves increase human sperm motility-A pilot study revealing the potent effect of 43 KHz radiation. *International J of Occupational Medicine and Environ Health.* 2018;31(6):723-39.
34. Ipsen J, Feigl P. *Bancroft's Introduction to Biostatistics.* Harper and Row, New York. 1970.
35. WHO Method Manual sixth edition. WHO. 2021.
36. Ajayi OO, Okoro JO, Ugbomoiko D, Akpoka OA, Erameh TO, Odigie EB. Non-Thermal Effect of the Brand and Generic Mobile Phones Radiofrequency Radiation on the Antioxidant and Histology of the Epididymis after Prolonged Whole-Body Radiation on Sprague Dawley Rat. *Med Lab Technol J.* 2023;9(1):79-92.
37. Alghannam MA, Gomaa RS, Abozaid ER, Diab YAA. Effect of exposure to cell phone radiation on testicular function of male albino rats. *Zagazig University Med J.* 2023;29(3):914-9.
38. Takahashi S, Imai N, Nabae K, Wake K, Kawai H, Wang J. Lack of adverse effects of whole-body exposure to a mobile telecommunication electromagnetic field on the rat fetus. *Rad Res.* 2010;173(3):362-72.
39. Wdowiak A, Wdowiak L, Wiktor H. Evaluation of the effect of using mobile phones on male fertility. *Ann Agric Environ Med.* 2007;14:169-72.
40. Kesari KK, Agarwal A, Henkel R. Radiation and male infertility. *Reprod Biol Endocrinol.* 2018;16:11-6.

Cite this article as: Jayram, Kumar M, Srinivasa MS. Human semen profile and mobile telephony: an original research study. *Int J Reprod Contracept Obstet Gynecol* 2025;14:2532-7.