



EFFECT OF CARRYING CELL PHONES IN TROUSER POCKETS, ON SEMEN PARAMETERS

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration between all authors. Author DALM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MKBW, JAL and HPW supervised the study. All authors read and approved the final manuscript.

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ABSTRACT

A cross sectional study was carried out in the fertility clinic of the Gampaha Wickramarachchi Ayurveda Hospital (August 2014 to August 2015) to screen the effect of carrying mobile phones in trouser pockets on seminal parameters. Though, the mobile phones are an important instrument in the modern society, emitting of possible harmful rays is the disadvantage. However, the attention on the area is not sufficient. Thus, the current study was set up to fill the gap. In the study the male individuals who visited the clinic were evaluated to gather the data on usage of mobile phones. Then semen of each subject was collected and analyzed separately. Out of all (n = 76) 49 were used to carry the phones in trouser pocket sat least a while per day as a custom. However, when comparing the average semen parameters of them (test) such as semen volume, concentration, motility and morphology with the sameness of the non-users (control), a statistically insignificant reduction were seen in all parameters of the test group (P>0.05). Thus, the usage of mobile phone in trouser pockets has a lesser effect on the semen parameters. Perhaps, this could be due to the habit of subjects of non-continuous usage of the phones in pockets.

Keywords: Mobile phone; trouser pocket; semen parameters; male fertility.

1. INTRODUCTION

Infertility is defined as the “inability of the female partner of the couple to conceive a child after having regular sexual intercourse in 1 year with non-contraception” [1]. Though previously it was believed that infertility was a problem of women, in the modern era, it is considered scientifically that the male as well as female both play an equal role in infertility. Thus, about 40 % of the issues involved

with infertility are due to male pathologies and another 40 % are due to the pathologies in female [2]. The rest is due to the pathologies in both sexes. Regarding the male factor infertility, 30-40% are due to the etiologies of unknown origin [3]. Among them, various environmental as well as lifestyle factors could be possible.

The carrying of cell phone, which is prevalent in modern society can be mentioned as an example for

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the lifestyle factors. The cellular phone emits radio magnetic waves at switch on mode. According to the scientific reviews, it has been disclosed that these waves are possible for potential adverse effects on heart, brain, as well as on DNA of animals, [4]. Anyway, the effect of these rays on reproductive system and associated infertility is not studied widely. Thus, the study was carried out to fill the gap to a certain extent.

The quality of semen is decided by main four parameters such as semen volume, sperm morphology, sperm count as well as sperm motility. The reference values of normal seminal parameters are as follows (WHO 2010).

Semen volume	- 2 ml
Semen count	- more than 25 million per ml
Semen motility	- more than 50% (collection of rapid and slow motility)
Semen morphology	- more than 30% (normal sperms)

Thus, in the present study the effect of mobile usage was screened against each four seminal parameters.

2. METHODS AND METHODOLOGY

2.1 Design: Cross Sectional Study

Sample size [5]

$$\text{Sample size} = \frac{4 Z_{\alpha}^2 P (1-P)}{D^2}$$

Z_{α} = standard normal deviate (at 95% confidence interval = 1.96)

P = prevalence of male infertility (8%) [6]

D = Total width of confidence (0.125)

$$\text{Thus, the sample size at 95\% of confidence interval} = \frac{4 (1.96)^2 \times 0.08 \times 0.92}{0.015625} = 72$$

2.1.1 The control group

The age matching, number equal (as much as possible) men who were not using mobile phones were selected from the same study population for the control groups [7].

2.2 Methods

The male partner of infertile couples who visited the fertility clinic of Gampaha Wickramarachchi Ayurveda Institute of Sri Lanka during the period of August 2014 – August 2015 was made involve in the study. The individuals who wished to take part in the study were evaluated on exclusive and inclusive

criteria on the consent. The exclusive criteria were strictly adhered as they can effect indirectly on seminal parameter [7].

Inclusive criteria:

- All the male, who were over 18 years old who wished to participate in the study.

Exclusive criteria [7]:

- Individuals, who had been lesser than 18 years old.
- Individuals, who had been suffering from systemic diseases such as diabetes, hypertension, cancer, arthritis during the period.
- Individuals, who had been on drugs relevant to above disease conditions.
- Individuals, who had addicted to recreational drugs such as marijuana, abin and ganja.
- Individuals, who had been on anti-gastric drugs such as cimetidine or any steroidal drugs.
- Individuals, who were with pathological issues in reproductive system (varicocele, testicular problems).
- Individuals, who were unable to communicate (dumb, deaf and mentally handicapped).
- Individuals, who were on fertility treatment at the time
- Individuals, who were unwilling to participate in the study.

The subjects who were satisfactory according to the criteria were selected for the study and were interviewed first to gather the lifestyle data on mobile usage as follows;

Whether use or not a mobile phone, If so, the way it's handled

If carried in trouser pockets; the mode (talk mode/switch on or switch off), time duration in the area, number of ringing, the way of keeping (key pad toward the body or away), the condition of the phone (whether the phone is maintained properly or not), availability of apertures in it to absorb electromagnetic rays. These data may be useful to evaluate the amount mobile exposures which was faced by the individuals.

Eventually, the subject was given a clean dry wide mouth glass container with advices to collect the semen by ejaculation (on the occasion, the subject must be three days of abstinence from ejaculation of semen).

The semen analysis [8].

Materials required

- Semen samples
- Test tubes
- Microscope and slide and cover slips
- Measuring cylinder
- Sahli pipette
- Neubaur counting chamber
- Semen diluting fluid
- Leishman stain

2.2.1 Analysis of semen volume [8]

After the liquefaction was taken place, the volume of semen was measured with 10 ml of measuring cylinder.

2.2.2 Analysis of sperm count [8]

The liquefied semen mixture was gently shaken to mix the specimen and using a Sahli pipette semen was drawn up to 0.5 µl mark. Then the semen diluting fluid was placed up to 11 µl mark and placed the pipette on a rotator to mix the interior contents well.

Thereafter, the Improved Neubauer counting chamber was loaded with the mixture and allowed the sperm to settle in. Eventually, the number of sperms in four corner squares were counted.

$$\text{Number of sperm/ml} = \frac{n \times 10 \times 20 \times 1000}{4}$$

n = number of sperm counted in all four corner squares

2.2.3 Analysis of sperm motility [8]

A drop of liquefied semen (10 µl) was placed on a clean slide and covered with a coverslip and rimmed the edge with petroleum jelly to prevent evaporation. It was observed the proportion of motile to non-motile sperms under high power field (X 40) in several microscopic field to obtain the average percentage of motile sperm. The motility of sperm was considered as the collection of slow and sluggish motility of the spermatozoa.

2.2.4 Analysis of sperm morphology [8]

A drop of liquefied semen (10 µl) was placed on a clean slide and made a thin smear and the smear was air dried. The dried smear was washed thoroughly with semen diluting fluid to remove the mucous. Then the smear was covered around 8 min with the diluted Leishman stain which was prepared by mixing 10 ml of stain and 20 ml of distilled water. Thereafter the stain was washed off well with buffered distilled water. Finally, the slide with stained smear was kept

to dry. The slide was observed for morphology (head, tail) under high power field and the ratio of normal to abnormal spermatozoa was observed in different microscopic fields to have the final average percentage of normal spermatozoa (finding of 30% or more normal sperm were considered as normal morphology).

3. DATA PROCESSING AND STATISTICAL METHODS

All the results were subjected to normality test and an abnormal distribution was indicted. Thus, the non-parametric test was used in the analysis of results (Wilcoxon signed rank test). The statistical package which was used was the IBM SPSS 20 versions.

4. RESULTS AND DISCUSSION

To detect the effect of mobile rays on the quality of spermatozoa, the individuals who carrying the mobile phones on switch on mode in trouser pockets as a custom were selected from the study group according to the details that they provided. Thus, the seminal parameters of them were compared with the control group. The men in the control group had not exposures to mobile rays and had normal, healthy semen (semen parameters with in the reference values of WHO guidelines in 2010). The average age and BMI of both groups were exactly similar to each other and were 35 years and 25 kg/m² respectively.

Upon the result, it was clear that all the average seminal parameters in the control group (non-exposed group), were higher than that of the test group (exposed group). Nevertheless, the every increases was statistically insignificant. Thus, according to the study, it is obvious that the quality of seminal parameters is independent on the mobile exposures.

When the data which were submitted by subjects were analyzed, it was evident that no one was continuously exposed to the mobile rays. The average time of having the mobile phone in talk mode in the trouser pocket was 20 minutes, which were ranged from 0 – 5 hours. From all, only 2 individuals had received a number of phone calls more than 10, while they were retaining the phones in trouser pockets. In this way, it's clear that the harmful effect of mobile rays might not suffice to make a burring effect in the study group. When a mobile phone is ringing it may emit electromagnetic rays. When someone keeps the phone in trouser pocket, the testis may be exposed to the rays. These rays could cause DNA damage as well as motility defect of sperms via the oxidative activity [9]. Anyhow, in the present study as the keeping such was so less, the effect of rays might have been minimized. Furthermore, the factors such as the brand

of the phone (certain phone brands have been recognized as better brands in the society), the condition of the phone (whether the phone was maintained properly and was working well) also depend on the intensity of emission of electromagnetic rays. Under the study all the phones were in good and quality condition and the average lifetime was 1 year.

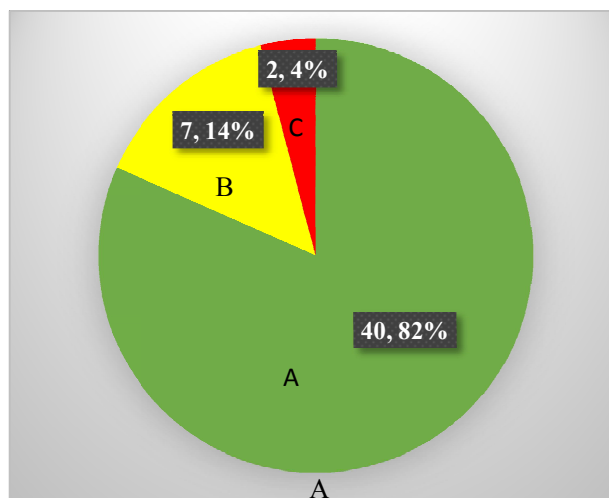
In a similar study, which was carried out by Agarwal et al. in 2008 [10], it was concluded that the mobile exposure had a close negative relationship with the semen parameters such as count, motility, morphology, and viability. Further, the researchers have mentioned that the strength of the effect of mobile rays directly depends on the period of exposure. In the present study (Munasinghe 2015 et al.) the average period of exposure was less than even 1 hour. Thus, the findings of the present study could be true due to the explanation of Agarwal et al. study.

In the study carried out in 2013 by Boulus and Hassan [11], the concept was further reconfirmed. The similar negative effect of mobile rays on the mobility of sperm had been recognized in the study of Adams et al. [9] and Jurewicz et al. [12] respectively.

Anyway an opposite conclusion was made by [13] in a study which was focusing to find the effect of period of exposure to mobile rays (0-30 min, 30-60 min, over 60min) and the way of carriage of the phone (in trouser pockets, in bags, on the belt) on the quality of semen parameters and found that there was no significant effect from both factors on the seminal quality. However, the same study was able to find that the usage of internet (either wireless or wired) could have a negative effect on seminal quality (count and motility). Thus, the findings of previous studies are rejected with the outcome of [13].

Table 1. The comparison of seminal parameters between two groups with mobile exposures (test) and non-exposures (control)

Semen parameter	Group with non-exposures to mobile rays (control) (n = 27)	Group with exposures to mobile rays (test) (n = 49)	P value (Wilcoxon signed rank)
Average Volume (ml)	2.64 ± 1.54	1.96 ± 1.20	P > 0.05
Average Count (10 ⁶ cells/ml)	64.24 ± 43.79	62.32 ± 44.93	P > 0.05
Average Morphology (normal form %)	42.35 ± 17.32	41.59 ± 18.70	P > 0.05
Average Motility (%)	58.48 ± 27.40	55.85 ± 27.41	P > 0.05



A = 0-30 min, B = 30 – 60 min, C = over 60 min

Fig. 1. The description of the duration of time of keeping the mobile phones in trouser pockets by the individuals in the study group (n=49)

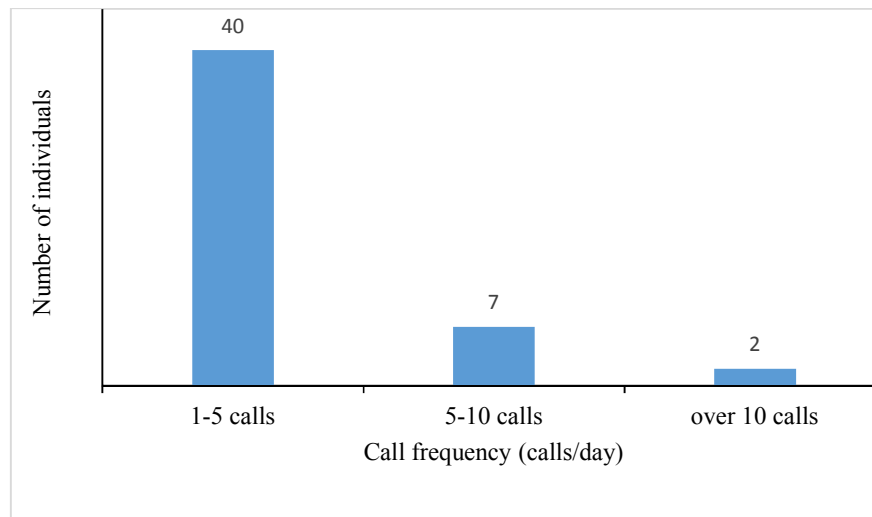


Fig. 2. The description of the frequency of calls obtained by the individuals in the study group (n=49)

When the outcomes of *in vivo* studies which are relevant to the present title are compared with that of *in vitro* studies, the outcomes of *in vitro* studies more align with the negative effect of mobile rays on seminal parameters.

According to the study [14] which was carried out *in vitro* by placing the semen samples of 16 healthy men near the switch on mobile phones, found out that the quality of seminal parameters (motility, count) was significantly decreased than that of the control sample (n=16, without mobile exposures) after a 5 hour. Anyway, the researchers had given a ring cut at every 10 mints to the phone which was near by the test samples. This was to expose the test samples to mobile rays. Furthermore, the distance between the phones and the samples had been kept by 5cm. Thus, the frequency of emission of radiation from the phone might be higher in this *in vitro* study to make an adverse effect on the semen samples. When it comes to the current study (Munasinghe et al. 2015) the total time of average exposure to mobile rays was less than 1 hour which might not suffice to make an adverse effect. Additionally, the barriers such as trousers, skin and fat of the individual might have minimized the strength of the rays. Moreover, the number of average calls per the time duration was also less in the present *in vivo* study in comparison to the *in vitro* study. Especially, in the human being, there is a biological antioxidant system to resist the oxidative damage of mobile rays for the DNA and cell membrane of the spermatozoa. Thus, the negative effect of mobile exposures might be low in human system rather than that of *in vitro* system.

In the study of Chang et al. [15] it had been further proved *in vitro*, that the mobile rays had a negative

effect on semen parameter such as sperm motility. Anyway, as a whole the reason for the difference of the outcome of the *in vitro* and *in vivo* studies could be due to the factors mentioned above.

Anyway, the mobile phone has become an essential instrument among the lives of modern society by globalizing the world. Thus, it's better to handle them carefully in a right manner, although in the current study there was no effect from mobile rays on semen quality.

5. CONCLUSION

It is feasible to mention that the keeping of mobile phones in trouser pockets on talk mode have no significant effect on seminal parameters according to the study.

This could be due to insufficient exposures of the study group to mobile rays due to the reason of non-continuous carrying of phones in trouser pockets which possibly reflects that the mobile users in the modern society are basically acknowledged about the bad effect of mobile rays. Anyway, it could be mentioned as a good habit among the individuals of the study group. However, it is better to carry out the study separately in other vulnerable groups such as uniform staff, office crowd, and bus conductors, tuition pupils who carry the phone usually in trouser pockets for longtime and receiving several calls per day. When the outcome of the present study (Munasinghe et al. 2015) is compared with that of the other foreign studies, it is clear that certain studies have mentioned a negative effect of mobile usage on seminal parameters. This could be due to the factors such as the race, the nature of the phone (the brand

and the life time), the duration and frequency of usage as well. Furthermore the individuals of those studies might have longer exposures to mobile rays than the individuals in the present study.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

This is to confirm that the participants consent have been obtained for the research study.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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