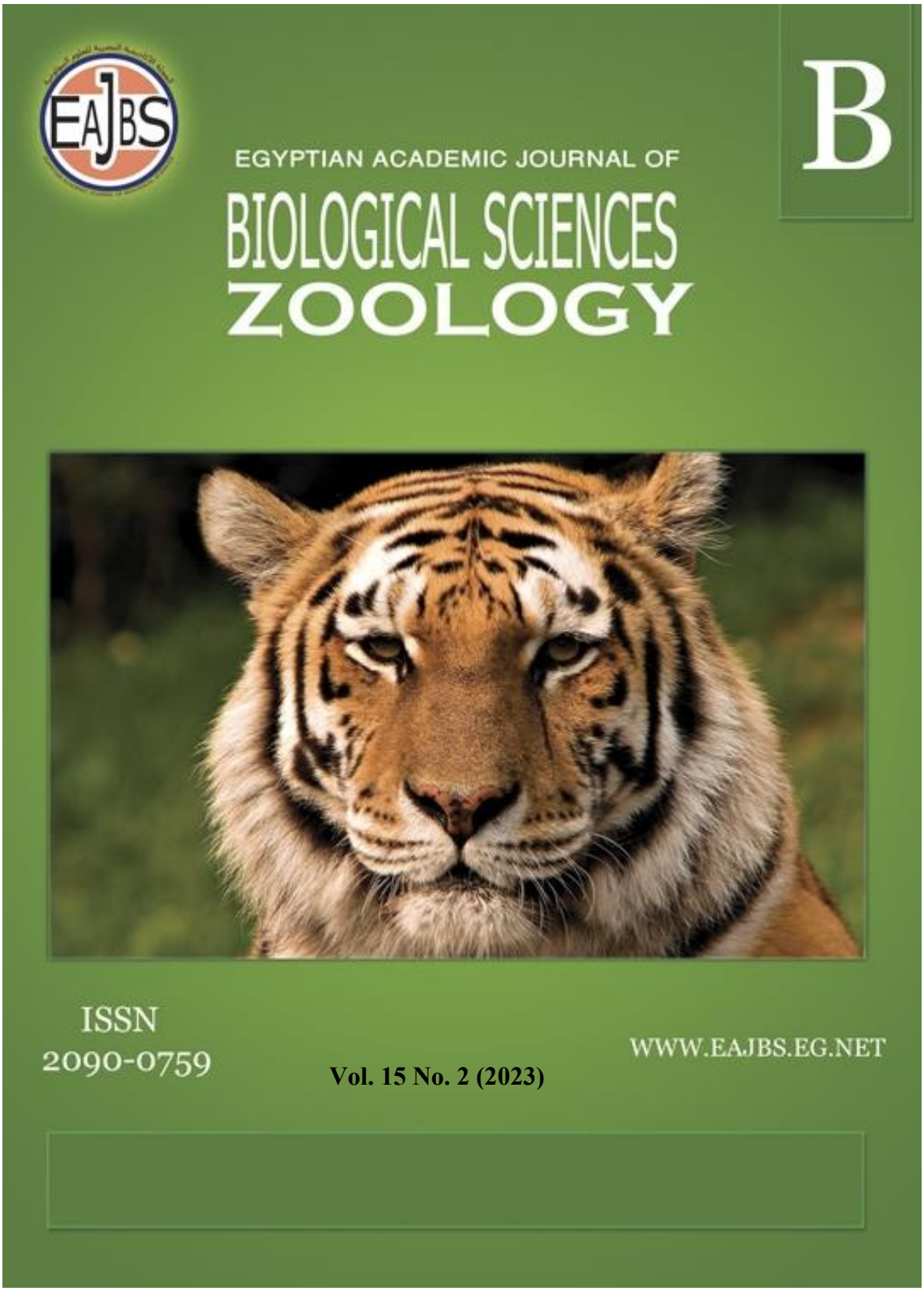

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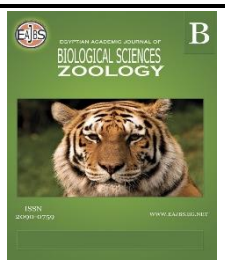

The Effect of Some Lifestyle Behaviours on Male Fertility and Their Effect on Sperm Quality and Linking Its Quality to Fertilization During Intracytoplasmic Sperm Injection (ICSI)

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ABSTRACT

Infertility is defined as the inability to achieve a clinical pregnancy during at least 12 months of consistent and unprotected sexual intercourse. This condition is characterized as a dysfunction of the reproductive system. Only men are thought to be involved in 45% of infertility cases, whereas 20% include both men and women. Male infertility is known to be influenced by variable lifestyle factors like smoking, radiation, or radioactive exposure that may harm biological tissue organs, such as the testis. Although there appears to be a link between increasing exposure to radiofrequency on mobile phones and decreased sperm quality, the evidence is not inconclusive. The primary lifestyle elements that contribute to a decline in male reproductive health are taken into account. These include aging, obesity, poor diet, inactivity, smoking, excessive alcohol use, stress, and low-level radio-frequency electromagnetic radiation (from mobile phones and portable computers).

This work aims to study the influence of smoking and electromagnetic radiation on the efficiency of fertility in males, their effect on sperm quality and efficiency, and fertilization rate. The study population included 100 couples who were referred to Al Azhar University's International Islamic Center for Population Studies and Research's Fertility Clinic for assisted reproduction. The obtained results showed that the smoking male recorded a remarkable decline in sperm count and motility, fertilization rate, and embryo grading. The multifactor group recorded the same results, in addition to a significant increase in abnormal sperm morphology.**Conclusion:** Personal wrong lifestyles such as smoking and exposure to electromagnetic waves led to a decline in male reproductive health and reduced sperm count, motility, morphology, fertilization rate, and embryo quality.

INTRODUCTION

Although one in every twenty men is infertile or sub-fertile, the causes of male infertility remain largely unknown. Although evidence is scarce, environmental influences and lifestyle decisions may be important, according to certain theories (Biggs *et al.*, 2023).

Typically, an inability to achieve conception after one year of regular, unprotected sexual intercourse. At the same time, subfertility refers to a reduced fertility rate or a longer time to conception. Both conditions can be diagnosed through medical evaluations and tests. For women, common tests for infertility and subfertility include measuring hormone levels, checking for ovulation problems, conducting a hysterosalpingogram (HSG) to evaluate the fallopian tubes and uterus, and performing a pelvic ultrasound to check for abnormalities or structural issues. Men can undergo semen analysis to assess sperm count, motility, and morphology. Following the American Society for Reproductive Medicine (ASRM), testing for infertility and subfertility should begin with a thorough physical examination and medical history, including assessments of both males and females. The ASRM recommends that couples who have been trying to conceive for 12 months or more without success seek an evaluation, while those with known risk factors or medical conditions should seek help earlier. Additional testing for infertility and subfertility may include genetic testing, laparoscopy, hysteroscopy, or other specialized procedures, depending on the individual case (ASRM 2021). Male infertility is known to be influenced by environmental and lifestyle variables. Heat, radiation, or radioactive exposure may harm biological tissue organs, such as the testis. The research is not conclusive, but there seems to be a connection between increased exposure to radiofrequency on mobile phones and a decline in the quality of sperm, (Sciorio *et al.*, 2021).

MATERIALS AND METHODS

The population understudying included 100 couples who were referred to Al Azhar University's International Islamic Center for Population Studies and Research's Fertility Clinic for assisted reproduction. Based on their lifestyle, the 100 male participants were classified into four groups; each group had 25 participants.

Group 1: Control
Group 2: Smokers
Group 3: Electromagnetic waves
Group 4: Multifactor (smokers exposed to electromagnetic waves)

Study Procedures:

The analysis of seminal fluid was done in accordance with WHO 2021 guidelines. Aspects The evaluation encompassed various aspects, including semen volume, sperm count, and morphology. Following microscopic examination, the sperm samples underwent processing for intracytoplasmic sperm injection (ICSI). In order to acquire an adequate number of motile and morphologically normal sperm cells for fertility treatments, a volume of 1 ml of sperm gradient medium was introduced to a freshly collected sample. The mixture was then subjected to centrifugation at a speed of 1800 rpm for 10 minutes. Following centrifugation, the supernatant was carefully eliminated. Subsequently, sperm-washing solvent (2 ml) was added to the sperm cells residing in the resultant pellet. The mixture was once again subjected to centrifugation at 1800 rpm for 10 minutes. The assessment of fertilization occurred between 16 and 18 hours following microinjection. The determination of oocyte fertilization was based on the presence of two pronuclei (2PN) and the extrusion of the second polar body. A suitable quantity of embryos was introduced into recipient organisms 72 hours following the microinjection. The patients received a quantitative serum beta-HCG test 14 days post-embryo transfer in order to ascertain their pregnancy status.

Statistical Analysis:

The results presented in the study were expressed as the mean ± standard deviation (SD). The statistical method employed in this study was the utilization of one-way analysis of variance (ANOVA). The statistical significance level was set at $P < 0.05$.

RESULTS

Table 1 shows the influence of various male lifestyles on semen parameters: the higher volume of semen was found in Group 2 (Smokers) at 2.5±1.32. In comparison, the lower volume of semen was found in Group 4 (Multifactor) at 1.46±0.67, and The observed alterations exhibited statistical significance at a significance level of $P < 0.05$. According to sperm count, a significantly increased sperm count was found in group 1 (control) at 34.16±12.86, while a significant inhibition was detected in group 4 (multifactor) at 16.12±6.63 ($P < 0.05$). Also, in total sperm motility, there was a significant elevation in group 1 (control) at 64.2±4.93, while significantly lower group 4 (multifactor) at 26.8±11.08 ($P < 0.05$). Moreover, the significantly elevated progressive sperm motility was recorded in group 1 (control) at 47.6±6.47. In contrast, significantly diminished progressive sperm motility was found in group 4 (multifactor) at 11.4±7.15 ($P < 0.05$). Whereas the remarkably higher non-progressive sperm motility was detected in Group 1 (control) at 16.6±5.72, while the remarkably lower non-progressive sperm motility was found in Group 2 (smokers) at 10.0±3.23 ($P < 0.05$). In contrast, the remarkably increased immotile sperm were investigated in group 4 (multifactor) at 73.2±11.08, while the remarkably decreased immotile sperm were examined in group 1 (control) at 35.8±4.93 ($P < 0.05$). Furthermore, the remarkably higher abnormal morphology was found in Group 4 (Multifactor) at 98.44±1.04, while the lower abnormal morphology was found in Group 1 (Control) at 96.68±2.95 ($P < 0.05$).

The outcomes in Table 2 revealed that a notably higher fertilization rate was detected in group 1 (control) at 88.77±7.77, while group 2 (smokers) reflected a significantly decreased rate at 61.49±7.98 ($P < 0.05$). Similarly, a significantly elevated embryo grade A was recorded in group 1 (control) at 82.96±11.5, while a significantly reduced embryo grade A was found in group 2 (smokers) at 62.94±13.74 ($P < 0.05$). In addition, a remarkably higher embryo grade B was reported in Group 2 (Smokers) at 37.06±13.74. In comparison, the significantly lower embryo grade B was reported in group 1 (Control) at 17.04±11.5 ($P < 0.05$). On the other hand, a significantly increased pregnancy rate was detected in group 1 (control) at 0.44±0.51, while a significant suppression pregnancy rate was detected in group 4 (multifactor) at 0.24±0.44 ($P < 0.05$).

Table 1: Illuastrates the influence of various male lifestyles on semen parameters.

Groups / parameters	Group 1 (Control)	Group 2 (Smokers)	Group 3 (Electromagnetic waves)	Group 4 (Multifactor)
	Mean± S.D	Mean± S.D	Mean± S.D	Mean± S.D
age	35.64±5.76^{bc}	36.32±5.62^{abc}	39.12±5.34^{ab}	40.12±5.39^{a}
volume	2.32±1.29^{a}	2.5±1.32^{a}	1.97±0.66^{ab}	1.46±0.67^{b}
Count	34.16±12.86^{a}	23.52±8.45^{c}	20.84±7.35^{cd}	16.12±6.63^{cd}
Total motility	64.2±4.93^{a}	44.2±5.89^{c}	42.2±7.37^{c}	26.8±11.08^{e}
Progressive	47.6±6.47^{a}	34.2±5.14^{b}	26.8±9.12^{c}	11.4±7.15^{e}
Non progressive	16.6±5.72^{a}	10.0±3.23^{b}	15.4±9.67^{b}	15.4±7.06^{b}
Immotile	35.8±4.93^{e}	55.8±5.89^{c}	57.8±7.37^{c}	73.2±11.06^{a}
Abnormal	96.68±2.95^{c}	97.88±2.05^{abc}	98.44±1.19^{ab}	98.44±1.04^{ab}
Normal	3.32±2.95^{a}	2.12±2.05^{abc}	1.56±1.19^{bc}	1.56±1.04^{bc}

Table 2: Fertilization and pregnancy rate.

Groups / parameters	Group 1 (Control)	Group 2 (Smokers)	Group 3 (Electromagnetic waves)	Group 4 (Multifactor)
	Mean± S.D	Mean± S.D	Mean± S.D	Mean± S.D
Fertilization rate	88.77±7.77^{a}	61.49±7.98^{d}	82.79±4.76^{ab}	65.21±10.63^{d}
Grade A	82.96±11.5^{a}	62.94±13.74^{cd}	76.67±12.9^{ab}	63.29±11.27^{cd}
Grade B	17.04±11.5^{d}	37.06±13.74^{ab}	23.33±12.91^{cd}	36.71±11.27^{ab}
Pregnancy	0.44±0.51^{a}	0.28±0.46^{a}	0.36±0.49^{a}	0.24±0.44^{a}

DISCUSSION

The current study was carried out to assess the effect of the Center for Population Studies and Research's Fertility Clinic on assisted reproduction.

In the present investigation, it is obvious that the effect of different lifestyles (modifiable risk factors) on semen revealed a higher significant semen volume in group 2 (smokers) at 2.5±1.32, while the lower semen volume was found in group 4 (Multifactor) at 1.46±0.67 ($P < 0.05$). Smoking poses significant harm to the reproduction process. (Kumar and Singh 2015). Smoking impairs spermatogenesis, sperm maturation, and spermatozoa function, as well as creating disorders with reproductive hormones. (Saleh *et al.,* 2002) By boosting the generation of seminal leukocytes, smoking also increases the amount of ROS. The increased creation of ROS, which finally results in sperm failure, is facilitated by leukocytes, particularly neutrophils and macrophages. Varicocele is a significant underlying medical condition associated with male infertility, serving as a prominent contributor to testicular oxidative stress (Agarwal *et al.,* 2014; Hamad *et al.,* 2014). Environmental factors and lifestyle are some of the external causes of ROS generation in the male reproductive system (Alahmar 2019). Lead, a toxin found in tobacco, is thought to directly affect spermatogenesis, sperm function, and reproductive system failure or testicular deterioration (Gandhi *et al.,* 2017). The current investigation revealed a more pronounced decrease in semen quality among individuals who smoked heavily (more than 20 cigarettes daily) and moderately (10-20 cigarettes daily) in comparison to mild smokers (1-10 cigarettes daily). The severity of effect size was found to be greater in males experiencing infertility compared to individuals in the general population. Smoking has been associated with a reduction in the quantity, movement, and morphology of sperm (Sharma *et al.,* 2010). is regarded as a notable risk element for the failure of intracytoplasmic sperm injection (ICSI) and in vitro fertilization (IVFIt probably has a more pronounced effect on the percentage of successful outcomes in assisted reproductive technology (ART) compared to maternal smoking, which is just a risk factor for IVF failure (Kovac *et al.,* 2015). Moreover, the clinical pregnancy rate per cycle of intrauterine insemination (IUI) may be influenced by the habit of smoking in males (Thijssen *et al.,* 2017). Numerous conditions can raise oxidative stress, which can cause a malfunction in the spermatozoa and infertility. These include pathologic disorders affecting the male reproductive system, systemic ailments, and environmental variables (Darbandi *et al.,* 2018).

Recent years have seen a rise in the number of individuals who own cell phones which use electromagnetic waves. As a result, it is now easier to analyze how phone use affects semen quality. Recently, there has been an obvious rise in the number of individuals who own cell phones, which emit non-ionizing radiation. As a result, it is now easier to analyze how phone use affects semen quality. The comprehensive assessment of the overall effects of mobile phone usage was conducted using a meta-analysis in 2011, which

incorporated data from 10 scholarly articles and encompassed a sample size exceeding 1500. Subsequent to the completion of this meta-analysis, further investigations have been conducted, yielding results that are in opposition to previous findings (Adams *et al.,* 2014). Mobile phones discharge radiofrequency-electromagnetic waves (RF-EMWs), which encompass RF-EMWs frequencies spanning from 800-2200 MHz. These waves possess the capacity to penetrate different parts of the human body and could pose risks to several physiological systems, including the cardiovascular, endocrine, and reproductive systems and brain (Al-Bayyari, 2017). Several studies have investigated a notable reduction in the quantities, viability, and mobility of sperms due to being subjected to RF-EMWs released by cellular devices (Agarwal *et al.,* 2008; Ding *et al.,* 2018b). Similarly, a multitude of epidemiological studies have indicated that the utilization of mobile phones might potentially exert adverse influences on the quality of semen. These include detrimental effects on sperm motility, viability, and normal morphology, along with a reduction in sperm count (Adams *et al.,* 2014; Agarwal *et al.,* 2008; Bisht *et al.,* 2017; Fejes *et al.,* 2005). Modern lifestyle factors that might have detrimental impacts on the process of spermatogenesis encompass instances of transient scrotal heat and extended periods of exposure to radiofrequency radiation associated with computer usage. (Sheynkin *et al.,* 2005). Thus, it can be concluded that cigarette smoking and exposure to electromagnetic waves significantly reduced sperm count, motility, morphology, fertilization rate, and embryo quality.

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ARABIC SUMMARY

تأثير بعض سلوكيات الحياة على خصوبة الذكور وتأثيرها على جودة الحيوانات المنوية والربط بين كفاءتها بالإخصاب أثناء الحقن المجهري

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3- المركز الدولي الإسلامي للدراسات والبحوث السكانية بجامعة الأزهر - الدراسة – القاهرة - مصر

يهدف البحث دراسة تأثير أنواع مختلفة من سلوكيات الحياة على جودة السائل المنوي للذكور أثناء عملية الحقن المجهري وكذلك تأثيرها على نسبة إخصاب وجودة الأجنة الناتجة من العملية. تمت الدراسة فى المركز الدولي الإسلامي للدراسات والبحوث السكانية بجامعة الأزهر على 100 من الذكور وقد تم تقسيمهم إلى 4 مجموعات: المجموعة الضابطة ومجموعة المدخنين ومجموعة المتعرضين للموجات الكهرومغناطيسية ومجموعة المدخنين المتعرضين للموجات الكهرومغناطيسية. وقد أظهرت النتائج إنخفاضا ملحوظا فى عدد الحيوانات المنوية وحركتها وكذلك فى معدل الإخصاب وجودة الأجنة فى مجموعة المدخنين, أيضا كانت نفس النتائج فى مجموعة المدخنين المتعرضين للموجات الكهرومغناطيسية إضافة إلى زيادة ملحوظة فى التشوهات فى الحيوانات المنوية.