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Impact of Selected Lifestyle Factors on Semen Quality in Iraqi Men[1]

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ABSTRACT

Background: Millions of people in their reproductive years are affected by infertility around the globe, which has consequences for their families and communities. Presently, various factors related to lifestyle (such as age, BMI, and smoking) are greatly responsible for male infertility. The primary goal of performing a semen analysis is to evaluate a man's ability to fertilize, estimate his fertility, and this process is comparatively easier, less invasive, and cheaper than examining the female.

Objectives: In Iraqi males of infertile couples, this study aims to establish the correlation between paternal age, body mass index, and smoking habit, and its impact on semen parameters.

Materials and Methods: During their attendance at a private infertility clinic from July 2021 to October 2022, a total of 120 couples struggling with infertility took part in the study. The males were subjected to semen analysis, following the guidelines set by WHO-1999. The study aimed to assess the impact of factors such as paternal age, body mass index, and smoking habits on semen parameters. These factors were then subjected to statistical testing to determine their significance.

Results: Secondary infertility, the most prevalent among all infertile couples (n=69), is characterized by inversely related sperm parameters when considering the duration of infertility. The decrease in sperm concentration, rapid progressive motility, and normal morphology resulting from the impact of aging process, body weight, and smoking habit was found to be statistically significant (p-value <0.05).

Conclusion: The relationship between male fertility and factors such as paternal age, body mass index, and smoking habit were observed in this study. It was found that the concentration of spermatozoa, progressive sperm motility, and normal sperm morphology were all negatively influenced by these factors. However, it should be noted that the volume of seminal fluid appeared to be unaffected.

Keywords: *Infertile couples; paternal age; paternal body mass index; semen parameters; smoking habit.*

INTRODUCTION

Infertility, a condition where couples are unable to conceive after a year of regular unprotected intercourse, is classified as a disease that affects the male or female reproductive system. The most common cause of male infertility is the issue of semen ejection [1]. It is important to evaluate both partners when dealing with infertility, as it can be caused by male factors, female factors, or a combination of both. Gathering information on the male's reproductive health can be obtained through initial semen analysis, sexual, lifestyle, and medical history [2]. Nowadays, environmental,

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occupational and lifestyle factors negatively influence both male and female fertility as well as the success of assisted reproductive technology (ART). In the modern world, unhealthy habits such as unhealthy diet, or lack of physical activity, smoking, using mobile phones, portable computers and alcohol consumption, all these can be considered as significant factors were influence the male reproductive health [3].

The decline in secretion of androgen levels as men age may suggest a deterioration in sperm parameters, which can be associated with significant reductions in pregnancy rates[4]. Despite this, the process of spermatogenesis continues well into old age. Even after reaching sexual maturity at forty years old, males can still contribute to conception. However, at the age of thirty, degenerative changes occur in the germinal epithelium, leading to a decrease in the number and functions of Leydig cells. This decrease in testosterone level influences the spermatogenesis process [5].

Accurate evaluation of ejaculates requires precise measurement of volume, which provides valuable insights into the secretory functions of the auxiliary sex glands. Additionally, volume measurement is essential for determining the total count of sperm, non-sperm cells, and biochemical markers [6]. While sperm concentration is a factor to consider, it is not a reliable indicator of fertilization potential. Conception can occur with just one sperm cell, making it the sole requirement for successful fertilization. Overall, superior sperm quality is often associated with strong motility [7].

Resulting in compromised physical and psychological well-being, obesity is a chronic disease that may also contribute to reduced fecundity [8].A In 2016, it was found that 39% of men aged 18 and older were considered overweight by their BMI. The body mass index (BMI) is commonly used to gauge overall health status based on weight, with "overweight" being classified as 25-29.9 kg/m2 and "obese" being classified as ≥30 kg/m2. The increase in body weight has been linked to an increase in certain chronic ailments, such as metabolic disorders (source: WHO) [9].

The prevalence of smoking in young adult males during their reproductive years is a significant public health issue[10]. According to WHO, approximately one third of individuals worldwide smoke, with males being more likely to smoke than females[11]. This habit can have negative effects on fertility in both men and women, surpassing the impacts of alcohol or caffeine consumption. Specifically, smoking can reduce semen quality and subsequently decrease the success rates of IVF and ICSI procedures[11].

MATERIALS AND METHODS

A During the period from July-2021 to October-2022, a private infertility clinic conducted a cross-sectional study on 120 male partners of Iraqi infertile couples. The registers for laboratory semen analysis were examined for this research..

- **Subjects:**

This study focused on men between the ages of 20-49 who were part of infertile couples. Those with chronic diseases like diabetes, kidney disease, and hypertension, as well as those who had a history of vasectomy and azoospermia, were not included. The participating males were divided into three groups based on their age, with the largest group being men between the ages of 30-39 (n=50).

Using the Leicester Height Measure, height for men without shoes was measured in centimeters. Men's weight was then measured in kilograms using the Seca 880 Weight Scale. The body mass index (BMI) was calculated using weight in kg divided by the squared height in meters (kg/m2)[13]. Men from couples experiencing infertility were categorized into three groups based on their BMI. The most substantial group was comprised of individuals who were overweight (n=58).

We divided the participants based on their smoking behavior, resulting in two main groups: those who had never smoked before (n=80) and those who were current smokers (n=40). We further differentiated the smokers based on their daily consumption: Group 1 consisted of individuals who smoked at least 20 cigarettes per day (n=25), while Group 2 included individuals who smoked hookah for a minimum of 2 hours each day (n=15). It is worth noting that both groups had been smoking for over 5 years.

- **Semen analysis:**

After 3-5 days of sexual abstinence, the seminal fluid sample was obtained by masturbating in a quiet, private room next to the semen analysis lab directly into a clean, dry, and sterile disposable Petri dish. The container containing semen must bear the following labels: name, age, abstinence duration, and time of sample collection. then left in an

incubator for 30 to 60 minutes at 37 oC to allow for liquefaction. After carefully blending the liquid semen for a short period of time, it underwent macroscopic and microscopic testing in accordance with the standard WHO-1999 form [14].

STATISTICAL ANALYSIS

A Completely Randomized Design (CRD) was utilized to investigate various lifestyle factors and their effect on different parameters of semen. Statistical analysis was performed using SPSS-software version 20, with a threshold for statistical significance set at a p-value <0.05. The results, expressed as mean ± standard error (mean ± SE), were obtained through a polynomial test [15].

RESULTS

According to type of infertility ,statistically no significant differences in all semen parameters was observed, except the concentration of spermatozoa were significant decrement in couples with primary infertility, as explain in table-1.

Table-1-The relationships between the type of infertility and semen parameters.

Parameter	Primary infertility (n=51)	Secondary infertility(n=69)	*P*-value
Volume	2.868±0.15a	2.810±0.17a	0.1
Sperm concentration(millions/ml)	41.158±2.63b	48.619±2.62a	0.01
Sperm motility %			
Rabid progressive motility	16.421±1.58a	16.143±1.40a	0.2
Slow progressive motility	28.579±1.80a	28.571±1.81a	0.3
Non-progressive motility	12.684±1.05b	15.667±1.75a	0.03
Immotile sperm	42.579±1.64a	39.619±2.08a	0.08
Normal sperm morphology	52.105±1.74a	49.524±1.64a	0.07
Pus-cell	7.211±0.88a	6.238±0.34a	0.6
Round-cell	3.474±0.34a	3.857±0.52a	0.5
Sperm Agglutination	6.316±0.40a	5.714±0.33a	0.9

- Significant different (P<0.05) in which (a)is highest value while(b)is lowest value
- Data are mean ± S.E

According to infertility duration, there is inversely relation between duration of infertility and concentration, rapid progressive motility ,and normal morphology of spermatozoa ,while the volume is unaffected , as shown in table -2.

Table-2-The relationships between infertility duration and semen parameters

Parameter	**2-5 years(n=67)**	**6-9 year(n=35)**	**>9years(n=18)**	***P*-value**
Volume	2.932±0.16a	2.708±0.23a	2.750±0.18a	0. 5
Sperm concentration (millions/ml)	45.000±2.94b	47.333±2.54a	40.833±3.92c	0.006
Sperm motility%				
Rabid progressive motility	18.500±1.60a	14.083±1.18b	12.500±2.60b	0.04
Slow progressive motility	24.682±1.67b	32.500±2.28a	35.000±2.71a	0.03
Non-progressive motility	18.545±1.65a	8.917±0.96b	9.167±0.83b	0.09
Immotile sperm	38.500±2.01b	44.500±2.12a	43.333±2.39a	0.02
Normal sperm morphology	54.773±1.62a	47.083±2.17b	43.333±1.34c	0.006
Pus-cell	6.727±0.58ab	7.667±1.00a	4.667±0.65b	0.03
Round-cell	4.455±0.51a	3.083±0.39ab	2.000±0.20b	0.08
Sperm Agglutination	5.955±0.39ab	7.000±0.35a	4.167±0.45b	0.07

- Significant different ($P<0.05$) in which (a)is highest value while(c)is lowest value
- Data are mean ± S.E

Impact of aging process on semen parameters, table -3-explained that the significant reduction in the sperm concentration, motility, and normal morphology with aging process. According to pus-cell, males within age group (40-49 years) shows highest value (8.200±1.15). Semen volume, round cell and sperm agglutination shows no significant difference ($P>0.05$) among these three male age groups.

Table -3: The effect of paternal age groups on semen parameters.

Parameter	20-29 years (n=43)	30-39 years (n=50)	40-49 years (n=27)	*P*-value
Volume	2.964±0.18 a	2.688±0.18 a	2.900±0.27 a	0.08
Sperm concentration (Millions/ml)	44.929±3.63 b	50.688±2.80 a	36.300±2.66 c	0.002
Sperm motility %				
Rabid progressive motility	20.786±2.13 a	16.000±1.56 b	10.400±0.60 c	0.004
Slow progressive motility	30.000±2.31 a	31.438±1.80 a	22.000±2.36 b	0.04
Non-progressive motility	11.071±0.89 c	14.125±1.34 b	18.900±3.25 a	0.02
Immotile sperm	38.500±2.26 b	38.438±1.58 b	48.700±3.19 a	0.03
Normal sperm morphology	56.071±2.11 a	47.813±1.59 b	48.000±2.43 c	0.009
Pus-cell	7.500±0.85 ab	5.063±0.37 b	8.200±1.15 a	0.04
Round-cell	3.643±0.39 a	4.188±0.68 a	2.900±0.32 a	0.06
Sperm Agglutination	5.929±0.46 a	5.875±0.39 a	6.300±0.53 a	0.09

- Significant different (P<0.05) in which (a)is highest value while(c)is lowest value
- Data are mean ± S.E

Table -4- shows the impact of paternal BMI on semen parameters. According to male BMI of infertile couples attended the private infertility clinic divided into three groups, the largest group was overweight (n=58).

Semen volume and sperm agglutination shows no significant differences (*P*>0.05) among these three groups, while the highest value of sperm agglutination within overweight group (7.000±0.35), other semen parameters such as concentration, motility, normal morphology , pus-cell, and round cell shows significant differences (*p*<0.05) among these groups were inversely related to increasing body weight. Regarding the pus -cell the highest value within overweight males (7.667±1.00) , while the highest value of round-cell within normal wight males (4.455± 0.51) were observed.

Table 4: The effect of paternal BMI on semen parameters.

Parameter	Normal weight(n=37)	Over weight(n=58)	Obese(n=25)	*p*-value
Volume	2.932±0.16 a	2.708±0.23a	2.750±0.18 a	0. 7
Sperm concentration (millions/ml)	45.000±2.94 ab	47.333±2.54 a	40.833±3.92 b	0.03
Sperm motility %				
Rabid progressive motility	18.500±1.60 a	14.083±1.18 b	12.500±2.60 b	0.03
Slow progressive motility	24.682±1.67 b	32.500±2.28 a	35.000±2.71 a	0.02
Non- progressive motility	18.545±1.65 a	8.917±0.96 b	9.167±0.83 b	0.04
Immotile	38.500±2.01 b	44.500±2.12 a	43.333±2.39 a	0.04
Normal sperm morphology	54.773±1.62 a	47.083±2.17 b	43.333±1.34 b	0.02
Pus-cell	6.727±0.58 ab	7.667±1.00 a	4.667±0.65 b	0.01
Round-cell	4.455±0.51 a	3.083±0.39 ab	2.000±0.20 b	0.04
Sperm agglutination	5.955±0.39 ab	7.000±0.35 a	4.167±0.45 b	0.05

- Significant different (P<0.05) in which (a)is highest value while(b)is lowest value
- Data are mean ± S.E

Smoking statues in relation to semen parameters was explained in table-5-, There is significant differences in regarding to concentration of sperm, rapid progressive sperm motility, and normal sperm morphology among all participants groups. The lowest value for sperm concentration, rapid progressive motility, and normal morphology were observed within hookah smoking. Regarding to semen volume, pus -cell, round-cell, and sperm agglutination were unaffected.

Table-5-The effect of smoking habit on semen parameters.

Parameter	Never smoker(n=80)	Smoking Cigarettes≥20 (n=25)	Smoking Hookah(n=15)	*P*-value
Volume	3.054±0.15 a	2.333±0.17a	2.333±0.17a	0.5
Sperm concentration (millions/ml)	42.214±2.37b	55.667±2.84 a	40.000±5.00b	0.01
Sperm motility %				
Rabid progressive motility	15.714±1.11b	21.778±2.67 a	5.000±0.00 c	0.008
Slow progressive motility	25.643±1.47c	33.333±2.31b	41.667±4.41a	0.002
Non progressive motility	15.893±1.35a	11.677 ±1.67b	6.667±0.83 c	0.005
Immotile sperm	42.750±1.61a	33.778±2.44b	46.667±4.64a	0.03
Normal sperm morphology	49.643±1.31b	56.667±3.07a	43.333±1.67c	0.01
Pus-cell	6.964±0.62a	5.556±0.41a	7.667±1.17b	0.05
Round-cell	3.429±0.28a	4.667±1.09a	3.000±0.29a	0.08
Sperm agglutination	6.286±0.31a	5.444±0.58a	5.000±0.01a	0.2

- Significant different (P<0.05) in which (a)is highest value while(C)is lowest value
- Data are mean ± S.E

DISCUSSION

As time passes, our bodies undergo a natural process known as aging, which impacts everyone and brings about a range of physical changes. One such change is a decline in reproductive ability. Advanced age has been connected to an increase in oxidative stress, resulting in the production of reactive oxygen species within the mitochondria and a rise in lipid peroxidation [16]. Testicular size starts to diminish once an individual reaches sixty years old. Aging has also been linked to changes in blood vessels, leading to testicular fibrosis and a higher likelihood of developing benign prostatic hyperplasia. These changes can have an impact on ejaculation and semen volume, as well as cause an elevation in gonadotropin levels associated with aging. Additionally, the levels of testosterone and the number of Leydig, Sertoli, and germ cells tend to decrease[17].

Studies suggest that there are changes in semen quality after exposure to toxic agents or the aging process, and thus, minimal semen concentration is affected [18,19]. On the other hand, some authors link the decrease in semen volume to the deterioration of the function of the accessory gland, a decrease in the daily production of sperm, its total number, and a decrease in its activity with age, which affects the vitality of sperm. Aging occurs at the age of forty [17]. Semen quality in general can be considered an indicator of male fertility, with decreasing semen parameters such as volume, motility, and/or shape of sperm. Infections of the male genital tract, localized testicular cancer, drug addiction or exposure to toxic substances may also cause azoospermia. In addition, the volume of semen in this study may be affected by age, long periods of non-ejaculation, and high temperature[20].

Increased levels of obesity in males can lead to imbalances in hormone levels, such as decreased testosterone and increased estradiol. These imbalances can have a significant impact on male reproductive function and increase the likelihood of poor semen quality[9]. The prevalence of obesity and overweight is rapidly rising in low and middle-income countries, especially in urban areas. Being overweight is associated with a greater risk of having a low sperm count or no sperm in ejaculate[21]. In the past few years, people have been increasingly concerned about the decline in sperm concentrations globally. This decrease could be linked to several lifestyle factors like obesity and exposure to environmental chemicals/radiations [22]. Obesity, a chronic disease, has negative effects on both physical and psychological health. Moreover, it can also impact fertility [23]. Nonetheless, the findings of this study align with previous research [24,25], indicating that sperm quality, particularly concentration and normal motile sperm cells, decline with increasing body weight.

Male infertility can be attributed to various factors, and tobacco smoking is considered one of the primary ones [26]. Surprisingly, in this particular study, smoking hookah was found to have a significant impact on sperm motility, but not on semen volume . This result is in line with previous research findings, further strengthening its validity [10,27]. Aromatic hydrocarbons seem to play a role in this mutagenic effect, alongside the toxic effects of nicotine, which disrupts the microcirculation in the testicles. Furthermore, the presence of carbon monoxide in cigarette smoke hampers the availability of oxygenated hemoglobin, thereby reducing the oxygen supply to sperm cells and ultimately resulting in sluggish sperms [28].

CONCLUSIONS

In the world today, male infertility is greatly influenced by lifestyle-related factors. The sperm concentration is the only parameter that was significantly higher in couples experiencing secondary infertility compared to those with primary infertility. Additionally, there is an inverse relationship between infertility duration and sperm parameters. Participating males in this population were not affected in terms of semen volume and sperm agglutination. However, it is worth noting that the aging process, increase in body weight, and smoking habit, particularly hookah, have been observed to have an adverse impact on various aspects of semen quality. These include concentration, motility, and morphology, ultimately resulting in decreased reproductive ability and lower sperm quality.

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Conflict of Interest

No conflict of interest identified.

Consent to participate

All participants obtained written informed consent before participating in the study.

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