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**Original Research Article**

# Prevalence and effect of age and body mass index on semen parameters among Saudi infertile males in Aljouf, Saudi Arabia

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## ABSTRACT

**Background:** Male infertility accounts for 40-50% of worldwide. The aim of the present study is to determine the prevalence and semen parameters that effects age and BMI among Saudi infertile males in Sakaka, Aljouf Saudi Arabia.
**Methods:** This are a cross-sectional descriptive and retrospective study of diagnosed 237 infertile males who were conducted at the infertility department of Maternity and Children Hospital (MCH) Sakaka, Aljouf Saudi Arabia, duration from January 2023 to January 2024. All related data was retrieved from a hospital's computerized data records files. The inclusion criteria of selected patients included age (<45 and >45 years), body mass index (BMI), type of infertility, duration of infertility, history of genital infection or trauma, history of smoking, history of taking any steroid drugs and mumps. Laboratory investigation data including hormonal assays and semen analysis were also gathered and considered as a P value<0.05.
**Results:** The prevalence of male infertility was 15%. The abnormal sperm parameters found mostly azoospermia 34.1%. While associated factors like smoking was significantly higher at 41.7% compared to others Relatively higher FSH, LH and prolactin hormones and lower testosterone were detected in infertile males. A total of means±SD of age, BMI and sperm count (x106) were 40.15 (5.10), 25.11 (2.88) and 21.28 and 23.25 respectively. The mean volume of sperm (ml) <45 years (2.26±1.42) was detected as higher significant (t=4.26, p=0.0005), while compared to normal weight males the volume of semen(t=1.60,p=.04), sperm count (t=3.02, p=0.03) and motility (t=3.94,p=0.003) were lower significant in obese.
**Conclusions:** The present study detected prevalence of infertilities males is 15% and is associated with abnormal sperm parameters, which is strongly related to age and BMI.

**Keywords:** Abnormal sperm, Basal mass index, Male infertility

## INTRODUCTION

Infertility is considered a reproductive health issue in the reproductive age. The prevalence of infertility is around 15% in infertility couples and exclusively 50% of males are infertile.[1] Although the definition of male infertility is the incapability of a male partner to a carryout pregnancy with a female fertile partner. According to the WHO, approximately 9% of infertility occurs mainly by concerns of fertility and among these contributed male factors are around 50%.[2] A previous study reported that sperm abnormalities metabolic disorders, stress, lifestyle, diet, hormonal disorder and as well other pathological events may contribute to male infertility.[3,4] Besides, it is evidence that the male prevalence of primary infertility variable is between 3.9% the 16.8%.[5] According to a survey of India, the prevalence of infertility is 40% contributed by male factors.[6] Conversely, the prevalence of the French population is 24%.[7] It has been estimated that smoking and sexually transmitted may increase the risk of infertility in addition to genetic causes.[8] Although, the adverse effects of smoking on the parameters of semen have changed,

suggesting smoking is a risk factor for male infertility. conversely, the development of sperm and genetic abnormalities, neurological disease, smoking, excess taking alcoholism, taking steroid drugs, sexually transmitted disease, the trauma of genital organs and testicular complication is the reason for the development of male infertility.[9] While the abnormalities of endocrinological hormones may lead to male infertility. previously reported, that excessive taking of anabolic steroids and cigarette smoking have adverse effects on spermatogenesis.[10,11] The abnormal semen parameters may cause congenital or acquired including systemic illness, undescended testes, trauma, nutrition environmental condition and lifestyle.[12] Previously reported that a decrease the male fertility was associated with advanced age. While it has been reported that testicular size effect due to advanced age, nutritional deficiency and disease conditions.[13]

Conversely, a decrease in semen volume and sperm mortality seeking in some previous studies with infertile males, besides detected the percentage of abnormal sperm morphology related to advanced age.[14,15] However, several studies estimated that increased BMI is directly correlated to male infertility and as well as the effect on semen parameters.[16,17] There was a deficiency study available about the relation of advanced age and body mass index with male infertility and semen parameters that correlate with them. However, there was no available data on this field in Saudi Arabia. Therefore, the present study determined age, BMI and semen parameters' effects on male infertility in addition to knowing the prevalence and associated factors.

## METHODS

This is a cross-sectional descriptive and retrospective study of diagnosed infertile males who were conducted at the infertility department of MCH Sakaka, Aljouf Saudi Arabia, duration from January 2023 to January 2024. A total of 237 patients participated by calculated and selected on the basis of the formula, formula: N=deff u2 P(1-P) /d2, where deff is the design effect; N, the sample capacity; u, 1.96 when the confidence coefficient is 95%; P, the probability value. Authors retrospectively collected data from 237 diagnosed infertile males from hospital computerized data records files.

The inclusion criteria included the age of all the participants broadly divided into those below the age of 45 and above the age of 45. All participants were divided into three groups: normal body weight overweight and obese according to their BMI, types of infertility, duration of infertility, history of smoking, infection any previous genital surgery and history of educational background. The present study also gathered laboratory investigation reports such as hormone assay and semen parameters (semen volume, sperm count and progressive sperm motility values). The present study aims to determine the prevalence of male infertility and determine the factor, semen parameters value and relation of the semen parameters with age and BMI. The ethical approval was provided by the scientific research committee of Jouf university.

### *Statistical analysis*

The data were analyzed using SPSS software version 22.0 and descriptive statistical tests, including frequency tables, graphs, mean, median and standard deviation were used. While the mean standard (mean±SD) of parameters of sperm quality between smoking and non-smoking were analyzed by descriptive statistics. chi-square was used to evaluate the correlations, Odd ratio and 95% Confidence Interval and analysis multivariate regression was performed to detect the correlation coefficients.

## RESULTS

A total of 237 diagnosed male infertility were conducted in the present study. Table 1 represented the demographic characteristic of all participants including the age range divided into below the age of 45 (58.64%) and above the age of 45 (41.35%) years, respectively. Besides present study found higher significant statistical age ranging between 20 to 30 years considered at p-value (p=0.0001). According to the body mass index (BMI) measurement, we divided it into normal 28.27%, overweight 33.33% and obesity 38.39% respectively and significance was found in obese male infertility compared to other body weights. However, we also found that primary infertility is 83.96% comparatively higher than secondary infertility at 16.03%. while the duration of infertility is 67.93% between 1 to 5 years which was higher compared to 24.89% and 17.7% between 6 to 10 and over 10 years.

Table 2 and Figure 1, displayed the finding associated with factors of male infertility, such as varicocele 24%, genital infection 34.17% and as well cigarette smoking 41.l7%. Therefore, smoking is considered a higher risk for male infertility compared to others.

The semen analysis report of all infertile males that presented in Table 3. The present study found the percentage of sperm abnormality with the number of participants affected included Azoospermia 34.17%, Asthenospermia 13.50%, Oligoasthenospermia 23.20%, Oligoasthenoteratospermia 20.67 %, Oligospermia 6.32%, Asthenoteratospermia 0.84% and Oligoteratospermia 1.26%.

Our results also determine the abnormal semen parameter between smoking and non-smoking infertile males, represented in Table 4 and Figure 2. Table 5 shows the prolactin and testosterone hormones increased compared to other hormones that were average. However, the value of hormonal levels distributed in table 5, the individual parameters of hormone levels in infertile males were prolactin 20.6% and normal 79.3% and FSH increased 37.9%, decreased 7.17% and normal 54.8%. While LH

increased by 31.6%, decreased by 4.6% and normal by 63.7%. However, testosterone highly decreased by 78.9% and by normal 21%, while 0% increased.

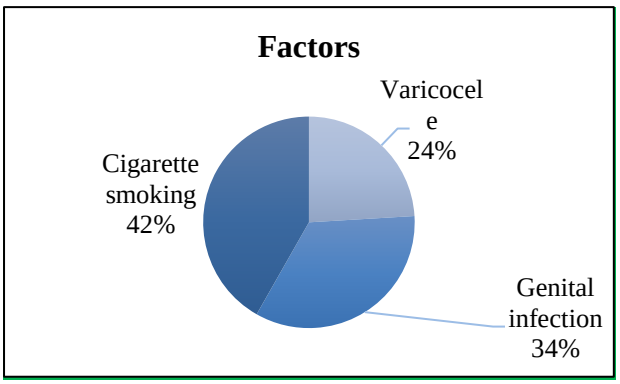



**Figure 1: Relation of factors with male infertility.**

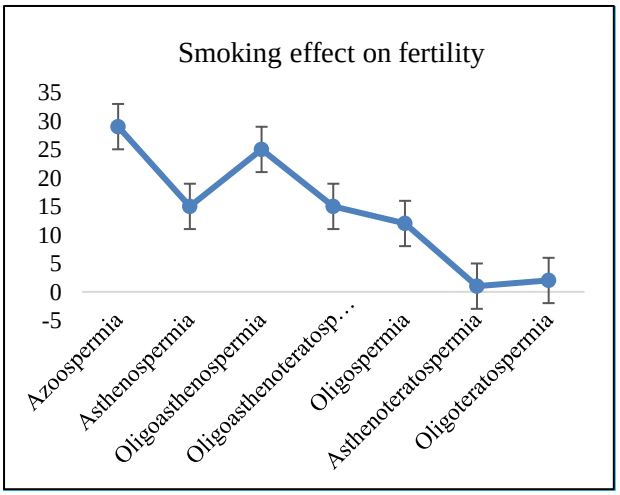



**Figure 2: Variable sperm abnormalities in infertile male.**

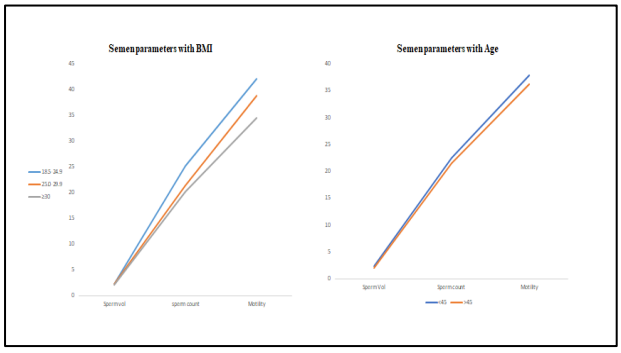



**Figure 3: Variables of semen parameters with age and BMI among infertile males.**

Data of analyzed semen with significance according to the relation of age and BMI

A total of 237 Saudi infertile males enrolled in the present study. The total means standard deviation of age (year) and BMI (BMI in Kg/m$^2$) was 40.15(5.10) and 25.11(2.88) respectively. The present study found the means (±SD) for the sperm volume, count and motility were 3.27±1.46, 21.28±22.07 and 37.15±21.50 respectively. The present study estimated a statistically significant difference (t=4.26 (0.0005)) was noticed in the mean volume of semen (ml) of infertile males aged below 45 (2.26 ml) versus those aged above 45 years (2.07) that considered age was significant for the production of semen volume. While there was no differentiation of sperm count and sperm progressive mortality regarding aged groups.

Conversely, there were exceptional variations detected in (t=160, p=0.04) in the volume (ml) of normal body weight males (2.35 ml) compared to males obese (2.15ml). However, the present study estimated a significant variation (t-3.01, p value=0.01 respectively) when body weight was normal with mean sperm count (x106/ml) (25.12) were as to which of over body weight males (21.38) and as well as the male's obese body weight (20.21). Furthermore, present results show the mean sperm progressive mortality (%) with normal body weight (42.07) was higher statistically significant as considered (t=3.03, P value=0.03) versus to over body weight males (38.73) and as well as obese males (34.44). All data represented with table 6 and Figure 3.

The present study analyzed the multivariate regression for the establishment of dependent and independent with and BMI. The age is independently significant at 2.15% with volume semen R2 and F and the p-value is 0.0215, 21.02 and 0.000 respectively. Besides, the body mass index presented little significance as 0.0026, 3.232and 0.133 respectively.

However, coaction between age and body mass index showed a significantly higher 2.24%. and R2, F and P values 0.0224, 10.32 and 0.000 respectively. Conversely, sperm count and motility displayed R2= 0.0003, 0.0017, F=0.17, 1.47, P=0.758 and0.329 for age and for BMI and coaction of age with BMI were R2=0.0051, 0.0052, 0.0126, 0.0141, F=5.415, 2.33, 11.451, 6.42 and p values, 0.044, 0.100, 0.001, 0.0027 respectively. The results showed BMI and BMI with age have a strong significance in sperm motility. While sperm count in BMI has been reported as significant which is represented in (Table 7).

**Table 1: Demographic characteristics of the study participants.**

| Variables | Male infertility (n=237) | % | P value |
|---|---|---|---|
| **Age (in years)** | | | |
| <45 | 139 | 58.64 | 0.0001 |

Continued.

| Variables | Male infertility (n=237) | % | P value |
|---|---|---|---|
| ≥ 45 | 98 | 41.35 | |
| **Body mass index (BMI)** | | | |
| 18.5 to 24.9 | 67 | 28.27 | |
| 25.0 to 29.9 | 79 | 33.33 | 001 |
| ≥30 | 91 | 38.39 | |
| **Type of infertility** | | | |
| Primary infertility | 199 | 83.96 | 0.001 |
| Secondary infertility | 38 | 16.03 | |
| Duration of infertility | | | |
| 1 to 5 years | 161 | 67.93 | |
| 6 to 10 years | 59 | 24.89 | 0.001 |
| ≥10 | 17 | 17.7 | |
| **History of smoking** | | | |
| Non-Smoking | 143 | 60.33 | 0.001 |
| Smoking | 99 | 41.17 | |
| **Education background** | | | |
| None | 61 | 25.7 | |
| Primary | 62 | 26.1 | |
| Secondary | 56 | 23.6 | NS |
| Tertiary | 58 | 24.4 | |

**Table 2: Factors related to male infertility.**

| Factors | Frequency | % |
|---|---|---|
| **Varicocele** | 57 | 24.05 |
| **Genital infection** | 81 | 34.17 |
| **Cigarette smoking** | 99 | 41.77 |
| **Total** | 237 | 100 |

**Table 3: Frequency of sperm concentration.**

| Variables | Number of participants (n=237) | % |
|---|---|---|
| **Azoospermia** | 81 | 34.17 |
| **Asthenospermia** | 32 | 13.50 |
| **Oligoasthenospermia** | 55 | 23.20 |
| **Oligoasthenoteratospermia** | 49 | 20.67 |
| **Oligospermia** | 15 | 6.32 |
| **Asthenoteratospermia** | 2 | 0.84 |
| **Oligoteratospermia** | 3 | 1.26 |

**Table: 4. Relation of abnormal sperm between smoking and non-smoking male infertility patients.**

| Factors | Smoking (n=99) | Non–smoking (n=143) | P value |
|---|---|---|---|
| **Azoospermia** | 29 (29.2) | 52(38.46) | 0.000 |
| **Asthenospermia** | 15 (15.1) | 17 (11.8) | 0.873 |
| **Oligoasthenospermia** | 25 (25.2) | 30 (20.9) | 0.592 |
| **Oligoasthenoteratospermia** | 15 (15.1) | 19 (13.2) | 0.341 |
| **Oligospermia** | 12 (12.1) | 2 (1.3) | 0.000 |
| **Asthenoteratospermia** | 1 (0.4) | 2 (1.3) | 0.726 |
| **Oligoteratospermia** | 2 (2.0) | 1 (0.6) | 0.938 |

**Table 5: Status of hormonal levels among all infertile males.**

| Reproductive hormones (n=237) | Increased (%) | Decreased (%) | Normal (%) |
|---|---|---|---|
| **Testosterone** | 0 (0) | 187 (78.9) | 50 (21%) |

Continued.

| Reproductive hormones (n=237) | Increased (%) | Decreased (%) | Normal (%) |
|---|---|---|---|
| **Prolactin** | 49 (20.6) | 0 (0) | 188 (79.3) |
| **FSH** | 90 (37.9) | 17 (7.17) | 130 (54.8) |
| **LH** | 75 (31.6) | 11 (4.6) | 151 (63.7) |

**Table 6: Semen parameters for all participants with mean stander deviation.**

| Variables | Element | Total | Body mass index | | Age | | Volume (ml) | | Sperm count x10$^6$ | | Motility of sperm (%) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Mean | ±SD | Mean | ±SD | Mean | ±SD | Mean | ±SD | Mean | ±SD |
| **Age (in years)** | All | 237 | - | - | 40.15 | 5.10 | 3.27 | 1.46 | 21.28 | 22.07 | 37.15 | 21.50 |
| | <45 | 139 | - | - | 37.22 | 4.12 | 2.26 | 1.42 | 22.48 | 23.45 | 37.88 | 21.36 |
| | ≥45 | 98 | - | - | 49.08 | 4.43 | 2.07 | 1.60 | 21.54 | 22.48 | 36.15 | 21.48 |
| ***t-test (P value)** | Compared above and below 45 years | | - | | | | 4.26 (0.0005) | | 0.34(0.22) | | 1.22 (0.23) | |
| **Body mass index (Kg/m2 )** | All | 237 | 25.11 | 2.88 | - | - | 3.27 | 1.46 | 23.25 | 22.05 | 37.19 | 23.55 |
| | 18.5-24.9 | 68 | 22.15 | 1.27 | - | - | 2.35 | 1.51 | 25.12 | 23.22 | 42.07 | 19.81 |
| | 25.0-29.9 | 110 | 26.21 | 1.36 | - | - | 2.31 | 1.55 | 21.38 | 22.21 | 38.73 | 21.68 |
| | ≥30 | 59 | 31.92 | 3.78 | - | - | 2.15 | 1.23 | 20.21 | 24.57 | 34.44 | 22.22 |
| *** t-test (P-value)** | 18.5 vs25 | | - | | | | -0.16 (0.42) | | -3.01 (0.01) | | -3.01 (0.01) | |
| | 30 vs 18.5 | | - | | | | -1.60 (0.04) | | -3.03 (0.03) | | -3.94 (0.003) | |

**Table: 7: Analysis of Multivariate regression associated semen parameters with age and BMI.**

| Semen parameters | Total | Age | | | Body mass index | | | Coaction of age and BMI | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | $R^2$ | F-statistic | P value | $R^2$ | F-statistic | P value | $R^2$ | F-statistic | P value |
| **Volume** | 237 | 0.0215 | 21.02 | 0.000 | 0.0026 | 3.232 | 0.133 | 0.0224 | 10.32 | 0.000 |
| **Count** | | 0.0003 | 0.17 | 0.758 | 0.0051 | 5.415 | 0.044 | 0.0052 | 2.33 | 0.100 |
| **Mortality** | | 0.0017 | 1.47 | 0.329 | 0.0126 | 11.451 | 0.001 | 0.0141 | 6.42 | 0.0027 |

## DISCUSSION

To our knowledge the prevalence of male infertility in Sakaka, Aljouf, is unknown. In the current study estimated the prevalence of male infertility is 15% in Aljouf, Saudi Arabia. Healthy sperm is produced by the healthy lifestyle of men, some lifestyles may responsible for the development of infertility such as extreme exercise causing deficiency of testosterone, excessive stress, malnutrition, anemia, the habits of smoking, excessive alcohol intake and exposure to a toxic environment.[18] Above all these reasons and the alteration of the endocrine reproductive hormone lead to abnormal spermatogenesis may lead to infertility. In the present study, the demographic criteria included age and we divided the age range among those below the age of 45 years (58.64) and above the age of 45 (41.35%) were a p value of 0.0001, while the above finding of approximately to another study.[19]

However, we determine the body mass index to relation infertility and based on we found 28.2%, 33.3% and 38.39% as considered p value 0.001. Many studies determined that obesity positively impacts male reproductive function. Although, the previous study on population-based and reported increased abnormal sperm parameters in both overweight and obese male infertility.[20,21] Our results show that primary infertility is 83.96% compared to secondary infertility 16.03%. In addition, the present results displayed 67.93%, higher in duration 1 to 5 years and 24.89% in 6 to 10 years and decreased 17.7% in more than 10 years duration of infertility and among them, the significant p value considered (p=0.001), similar results found in another study.[22] This increased the duration of infertility because of the lack of awareness of men cause infertility. However, the present study found that 60.33% of smoking and 41.17% of non-smoking in infertile men and statistical significance considered at a p value of 0.001. while 57.6% of non-smoking and 42.4% of smoking were detected in infertile males in another study.[18] The present study in Table 4 represents the variety of abnormal sperm parameters with percentages that included Azoospermia, Asthenospermia, Oligoasthenospermia, Oligoasthenoteratospermia, Oligospermia, Asthenoteratospermia and Oligoteratospermia were

34.17%, 13.50%, 23.20%, 20.67%, 6.32%, 0.84% and 1.26% respectively.

Authors also compared the sperm parameter between smoking and non-smoking and found a significantly higher 12.1% of oligospermia in smoking and 38.46% azoospermia in no-smoking infertile males. Therefore, this result clearly indicates that cigarette smoking has a toxic effect on the sperm which is sustained by other reports.[10,23] Follicle-stimulating hormone (FSH) and luteinizing hormone (LH) stimulated the less of testosterone hormone, while a higher level of FSH and LH negative impact on the hypothalamic-pituitary-gonadal axis and decreased the secretion of testosterone hormone.[24] The present study determined a high level of LH and FSH, prolactin and low level of testosterone hormone. The mean serum testosterone levels were found lower in our all participants than in the normal value and similar results were found in other studies.[25] Being overweight and obese subsequently affects the male reproductive system, besides, higher body mass index and advanced age individually cause a decrease or abnormal semen parameters. The present study determines that the mean volume of sperm (ml) in men aged 45 and over 45 years is considered lower significant compared to those aged below 45 years, while similar reports are presented by several studies.[26] Conversely, some studies reported the advanced age of males lead to lower seminal fluid due to inadequate seminal vesicle and atrophy of the prostate.

In the results, all participants were divided into two age groups aged below 45 years (n=139) and aged above 45 years (n=98) a significant variable of semen volume was found 2.26ml and 2.07 ml respectively, several studies supported our results.[27,28] However, in the case of obese the mean sperm volume was lower significantly than normal body weight males. In all ranges of BMI above the age group 45 years old males showed lower sperm volume compared to ages below 45 years old, these findings suggested that age is significant versus BMI may decrease the production of seminal fluid. However, several studies presented similar reports.[29,30] Indeed, being overweight and obese has a negative impact on semen production that affects fertility, because of dysfunction of the hypothalamic-pituitary-gonadal axis or abnormal production of reproductive hormones.

## CONCLUSION

The prevalence of male infertility is 15% in Aljouf Saudi Arabia. The present study estimated a significant effect of age on the semen parameters of infertile males. Our results suggested age of males is intimately related to lower sperms number. This study also revealed that obesity and high levels of FSH, LH and prolactin hormones and lower levels of testosterone cause infertility. In addition, higher serum prolactin and lower serum testosterone were significantly associated with a variety of sperm parameters. Our results also demonstrate the relation of semen parameters with age and BMI that undesirable effects the sperm quality and quantity. This study on conducted in one hospital and look interesting for future research with more patients from multiple hospitals.

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