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Semen Quality Parameters in Male Partners of Infertile Couples and Their Correlation with Socio-demographic Features in Rural Tertiary Care Center of Southern India: An Observational Study

Naina Kumar[1]*, Amit Kant Singh[2]

[1] MBBS, MD, Associate Professor, Department of Obstetrics and Gynecology, All India Institute of Medical Sciences, Bibinagar-508126, Hyderabad Metropolitan Region, Telangana, India

[2] MBBS, MD, Professor, Department of Physiology, U.P. University of Medical Sciences, Saifai, Etawah, Uttar Pradesh, India

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Abstract

Background: Infertility especially male factor infertility is on a rising trend all over the world due to numerous factors including environmental, lifestyle factors, occupation-related, faulty dietary habits, etc. The present study aims at establishing a correlation between various demographic features of male partners of infertile couples with their semen analysis report. *Methodology:* Present retrospective observational study was conducted in the infertility clinic of a rural tertiary care center of Southern India over one year (August 2019 to July 2020). A total of 114 male partners of infertile couples fulfilling the inclusion criteria were enrolled. The impact of socio-demographic features including age, BMI, occupation, religion, duration, type of infertility, and history of addiction on semen parameters was studied. *Results:* Of 114 participants, 82 (71.9%) had primary infertility and 32 (28.1%) secondary. Of these 39(34.2%) had male factor infertility. The average (mean±SD) sperm concentration, total motility, dead and morphologically normal sperm of all participants were 47.51±37.5 million/ml, 46.96±22.8, 27.18±17.9, and 65.77±35.4 respectively. The most common abnormality on semen analysis was the combination of different abnormalities (25.6%), followed by azoospermia (23.07%), oligozoospermia (17.9%), and teratozoospermia (17.9%). A significant inverse correlation was observed between body mass index and personal addiction with sperm motility. No significant correlation was found between male partner's age, occupation, religion, duration, and type of infertility with semen parameters. *Conclusion:* Various modifiable factors harm male fertility including smoking, alcohol, obesity, occupational exposure to heat, and chemicals. The impact of male partners' age on semen parameters could not be established.

Keywords: Infertility; Male; Occupations; Semen; Spermatozoa

Introduction

World Health Organization (WHO) has defined infertility as a male or female reproductive system disease characterized by the failure of a couple to conceive even after ≥12 months of regular unprotected sexual contact [1]. Infertility affects millions of people worldwide with an estimated 48 million couples and 186 million individuals living with infertility as per the recent WHO figures [1]. India alone has a burden of 27.5 million infertile couples, according to recent data [2]. Furthermore, recent years have observed an alarming rise in male infertility cases. Male infertility is defined as the inability of a male partner to make a fertile woman pregnant [3] and it accounts for 50% of all infertility cases [4]. Semen analysis to date is the most efficient method for diagnosing male factor infertility [5]. It gives information about sperm parameters including count, concentration, motility, morphology, vitality, and semen quality, and thus helps in identifying the cause of male infertility. Men having semen parameters below WHO, 2010 normal reference values are considered to have male factor infertility [6]. There are numerous factors responsible for the rising trend of male infertility observed in today's era including environmental factors, pollution, extreme temperature changes, obesity, older age, alcohol consumption, smoking, occupation-related, heat or chemical exposure, sedentary lifestyle, genito-urinary infections, varicocele, congenital defects, faulty dietary habits, etc [7]. Hence, the present study aims at establishing the correlation between various demographic features of male partners of infertile couples including age, religion, occupation, addiction, body mass index with the pattern and type of infertility, male partner semen analysis report in couples reporting to the infertility clinic of a rural tertiary care center of Southern India over one year.

Material and Methods

Study Design a retrospective observational study. The present study was conducted in the infertility clinic run by the Department of Obstetrics and Gynaecology of a rural tertiary care center in Southern India over one year (August 2019 to July 2020).

Corresponding author: Naina Kumar (ORCID number: 0000-0002-5970-6935), MBBS, MD, Associate Professor, Department of Obstetrics and Gynecology, All India Institute of Medical Sciences, Bibinagar-508126, Hyderabad Metropolitan Region, Telangana, India, Email: drnainakumar@gmail.com, Mobile No: +91-9552515600

Participants

Inclusion criteria

All male partners of infertile couples reporting to the infertility clinic of a rural tertiary care center of Southern India were included as study participants.

Exclusion criteria

Couples reporting to the Gynecology outpatient department for reasons other than infertility, men with congenital malformations of the reproductive tract (congenital hypospadias, epispadias, penile malformations, undescended testes, bilateral absence of vas deferens), men who have undergone vasectomy, those suffering from genital infections and those refusing to participate were excluded from the study.

Sampling Procedure

A consecutive sampling of participants fulfilling the inclusion criteria was done for the entire duration of the study.

Variables

The impact of independent variables like male partner's age, religion, Body Mass Index (BMI), occupation, personal addiction, duration, and type of infertility on semen analysis report including sperm concentration, motility, vitality, and morphology was studied. The potential confounders were sedentary lifestyle, dietary habits, pollution, occupations with excessive exposure to heat or chemicals, cultural taboos, varicocele, past history of genital tract surgeries, or treatment taken for infertility.

Data Sources/Measurements

The various socio-demographic features including age, weight, height, BMI, occupation, religion, marital status, previous conception history (if secondary infertility), history of addiction, duration of infertility was all recorded on a preformed data collection sheet by trained nursing staff, after Institutional Ethical Committee approval and informed written consent from all the selected participants in their vernacular language. A detailed medical, surgical, and family history of all the participants was recorded, followed by a thorough physical examination of the female partner. This was followed by the semen analysis of the male partner according to the WHO 2010 laboratory manual guidelines [3].

Sample collection and preparation

Semen sample collection and preparation were done according to WHO 2010 criteria for semen analysis [3]. A semen sample was collected in a private room near the laboratory, to avoid exposure of the semen to temperature changes and to prevent time delay between collection and analysis of the sample. The male partner was advised to have sexual abstinence for a minimum of two days and a maximum of seven days. The semen sample was obtained by masturbation following all aseptic measures including washing of the hands and penis with soap and water to avoid any contamination by skin commensals and ejaculated in a sterile wide-mouthed plastic or glass container from a batch confirmed to be non-toxic for sperms. The sample container is then kept at 37 °C temperature for 15-30 minutes for semen to liquefy. After semen liquefaction, the semen appearance, viscosity, volume, and pH are measured followed by the microscopic investigation of semen including sperm agglutination, motility (progressive, non-progressive, or immotile), vitality, total sperm count and sperm concentration, morphology, and cells other than spermatozoa in semen [3]. All the findings were recorded on a data sheet having details of the participant including name, age, code number, period of sexual abstinence, date, and time of collection. The report was prepared as per the reference values given in the WHO 2010 laboratory manual for the examination and processing of human semen [3]. The semen analysis report of each participant was entered in detail including semen volume, sperm concentration, motility, vitality, morphology along with the final impression in an excel sheet for analysis and comparison.

Study size

A total of 121 male partners of infertile couples fulfilling the inclusion criteria were enrolled as study participants.

Quantitative variables

The male participants were grouped into 3 categories based on their age (26-30 years; 31-35 years and 36-40 years). This helped in establishing a correlation between male partner's age and semen parameters. The other quantitative variables like semen volume, sperm concentration, motility, vitality, and morphology were reported according to WHO 2010 laboratory manual with a reference range as shown: semen volume: 1.5-7.6 ml, sperm concentration: 15-259 million/ml, total motility: 40-81%, progressive motility: 32-75%, vitality: >58%, sperm morphology: 4-48% [3].

Operational Definitions

Primary Infertility is primary infertility is defined as a couple who has never conceived [1]. Secondary Infertility is failure to conceive by a couple following a history of the previous conception is defined as secondary infertility [1]. Normozoospermia is men whose semen parameters are within the range of WHO (2010) reference values, that is sperm concentration >15 million sperm/ml of semen, with 58% sperm vitality, 32% progressive motility, and ≥ 4% morphological normal forms of sperm [3]. Oligospermia is men have decreased the number of sperm in the ejaculate (<15 million sperm/mL). It is further subdivided into mild (10–15 million sperm/mL), moderate (5–10 million sperm/mL), and severe (< 5 million sperm/mL) types depending on the sperm concentration/mL [3]. Azoospermia is defined as the absence of sperm in the ejaculate [3]. Asthenozoospermia is defined as decreased sperm motility. Complete Asthenozoospermia is 100% immotile sperms in the semen [8]. Teratozoospermia is the presence of morphologically abnormal sperms in the semen. It is characterized by the presence of more than 96% sperms with abnormal morphology in semen samples [3]. Necrozoospermia is defined as the percentage of living spermatozoa <58% in the fresh semen sample [9].

Statistical Analysis

Statistical analysis of data was performed using Statistical Package for Social Sciences (SPSS) software version 22.0. Socio-demographic variables including the age of the male partners, occupation, addiction, infertility status, and type were compared using Student's "t" test and expressed as absolute frequencies and percentages, as per the distribution of data. The quantitative variables such as BMI, semen volume, sperm concentration, motility, vitality, and morphology were expressed as mean ± standard deviation of the mean with a p-value <0.05 as significant.

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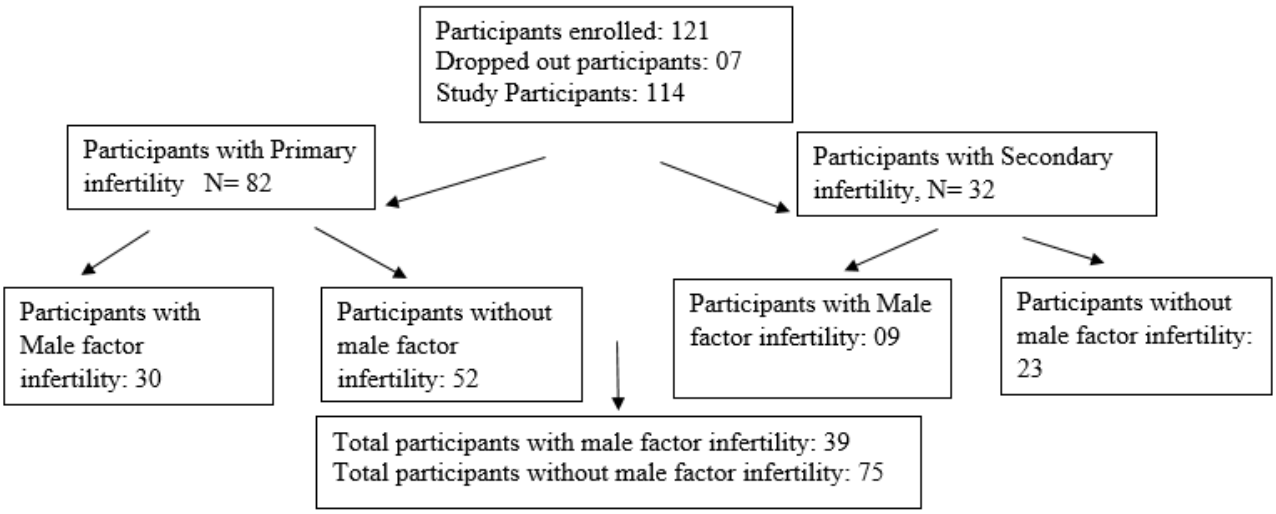

Figure 1: Flow-Chart of Participants

Results

Of total one hundred and twenty (121) infertile couples enrolled in the study, seven were excluded as one had the congenital absence of bilateral vas deference, one congenital absence of left testes diagnosed on routine ultrasound, two had severe infection with numerous pus cells on semen analysis, and three refused to be a part of the study. Hence, of the remaining 114 infertile couples included in the study, 82 (71.9%) had primary infertility and 32 (28.1%) secondary infertility. Of all infertile couples, 39(34.2%) had male infertility, as depicted in the flow chart that is shown in Figure 1.

Descriptive data

The average age of all the male participants was 31.85±5.03 years with the majority belonging to the 31-35 years age group (42.1%). The majority of the participants belonged to the Hindu religion (77.2%). Most of the male partners of couples were professionals by occupation (25.4%) followed by casual laborers (23.7%). Of the total 114 participants, 12 (10.5%) had a history of addiction. The various socio-demographic features studied are depicted in Table 1. *Outcome Data:* Of 114 male participants of infertile couples, 75(65.8%) had normozoospermia and 39(34.2%) had some form of male factor infertility diagnosed on semen analysis. The average semen volume of all the participants was 3.2ml. Of those with male factor infertility, nine (23.07%) had azoospermia, seven (17.9%) oligozoospermia, seven (17.9%) teratozoospermia, six (15.4%) asthenozoospermia, and 10(25.6%) a combination of different abnormalities on semen analysis (oligoasthenospermia, oligoasthenoteratozoospermia, oligoteratospermia). The correlation of semen parameters with the male partner's age, occupation, and addiction is depicted in Table 2. The average (mean±SD) sperm concentration, total motility, dead and morphologically normal sperm in all the participants were 47.51±37.5 million/ml, 46.96±22.8, 27.18±17.9, and 65.77±35.4 respectively. The correlation of sperm concentration, motility, vitality, and morphology with male partner's BMI is depicted in Table 3. No significant difference was observed between semen parameters of male partners with primary or secondary infertility and with the duration of infertility ($p>0.05$).

Table 1: Socio-demographic features of the infertile couples

PARAMETER	NUMBER (n)	PERCENTAGE (%)
Age (Years)		
26-30	43	37.7%
31-35	48	42.1%
36-40	23	20.2%
Occupation		
Professional worker	29	25.4%
Casual Laborer	27	23.7%
Businessman	25	21.9%
Police	21	18.4%
Automobile Driver	10	8.8%
Teacher	02	1.8%
Religion		
Hindu	88	77.2%
Muslim	15	13.2%
Christian	11	9.6%
Body Mass Index		
Underweight	04	3.5%
Normal	29	25.4%
Overweight	53	46.5%
Obese Class I	17	14.9%
Obese Class II	09	7.9%
Obese Class III	02	1.8%
Addiction (Smoking, alcohol, tobacco)		
Yes	12	10.5%
No	102	89.5%
Duration of Infertility (years)		
<5	50	43.9%
5-10	49	43%
>10	15	13.2%
Type of Infertility		
Primary	82	71.9%
Secondary	32	28.1%
Semen Analysis Report		
Normal	75	65.8%
Azoospermia	09	7.9%
Oligozoospermia	07	6.1%
Teratozoopsermia	07	6.1%
Asthenozoospermia	06	5.3%

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Combination of abnormalities	10	8.8%

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Table 2: Correlation of semen analysis report with the age, occupation and addiction of male partner.

Parameter	Sperm concentration (million/ml)	Total motility (%)	Rapid progressive motility (%)	Sluggish motility (%)	Dead sperms (%)	Normal morphology (%)
AGE (YEARS)						
26-30	47.5±35.3	46.8±22.4	34.7±18.4	23.02±16.4	25.4±18.2	63.7±38.3
31-35	51.2±40.7	46.8±24.2	33.9±18.6	21.3±13.8	28.8±18.5	65.6±33.9
36-40	39.9±34.9	47.7±21.3	35.6±19.2	19.9±10.8	27.1±16.4	69.9±33.8
F	0.705	0.017	0.064	0.393	0.419	0.225
p-value	0.496	0.984	0.94	0.676	0.659	0.799
OCCUPATION						
Professional	45.3±39.4	47.2±23.7	35.1±20.9	19.8±13.4	26.2±17.0	66.4±34.1
Casual Laborer	52.9±42.3	48.7±24.6	35.0±18.6	24.2±16.0	25.9±16.7	62.7±38.7
Businessman	51.4±38.1	41.3±24.0	29.9±17.4	18.6±12.8	27.8±20.8	71.8±32.8
Police	35.0±31.6	45.0±22.0	34.0±18.7	24.1±15.3	32.8±19.3	60.2±39.1
Automobile driver	54.3±25.0	56.0±8.9	40.6±11.0	23.9±13.9	21.2±11.3	64.1±34.2
Teacher	55.0±57.9	65.0±21.2	52.5±24.7	12.5±10.6	21.0±26.9	89.0±12.7
F	0.727	0.932	0.903	0.825	0.726	0.452
p-value	0.604	0.604	0.482	0.534	0.605	0.811
ADDICTION						
No	46.0±37.0	47.4±22.4	35.1±18.4	20.6±13.2	27.1±18.6	64.9±35.9
Yes	56.8±41.6	42.9±26.2	30.0±20.7	30.2±19.9	27.9±10.9	72.7±31.3
t	-0.910	0.649	0.898	-2.250	-0.149	-0.711
p-value	0.365	0.518	0.371	0.026	0.882	0.478

Table 3: Correlation of Body mass index of male partners with their semen parameters

Body Mass Index (BMI)	Normal	Underweight	Overweight	Obese I	Obese II	Obese III	F	p-value
Semen Parameters	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD		
Sperm conc/ml (millions)	39.6±33.4	69.0±29.6	52.9±39.9	41.4±33.9	48.3±44.2	25.7±36.4	0.963	0.444
Total motility (%)	42.9±24.1	58.8±4.8	52.3±18.7	42.2±25.1	36.9±31.1	25.0±35.4	1.933	0.095
Rapid progressive motility (%)	33.9±22.2	45.3±11.3	38.6±14.8	30.0±19.7	20.7±17.3	17.5±24.8	2.480	0.036
Sluggish motility (%)	21.4±13.9	25.5±7.3	22.6±14.6	19.6±14.1	19.6±17.1	17.5±24.7	0.243	0.943
Dead sperms (%)	26.8±23.3	24.7±11.8	29.7±11.3	28.3±25.1	15.6±13.8	12.5±17.7	1.292	0.273
Normal morphology (%)	62.0±38.4	76.0±35.2	69.7±30.4	65.7±39.6	55.0±44.1	46.0±65.0	0.540	0.745

Main Results

No significant correlation was observed between male partner's age, occupation, religion, duration, and type of infertility with the semen parameters, though a significant correlation was found between male partner's addiction with sperm motility, that is males with a history of addiction were found to have sluggish sperm motility. A significant inverse correlation was observed between the male partner's body mass index and sperm motility, with an increase in body mass index the rapid progressive motility of sperm decreases.

Discussion

In the present study, male factor infertility was found in 34.2% of infertile couples. The mean age of all the male participants was 31.85±5.03 years with the majority belonging to the 31-35 years age group (42.1%). Of all the participants 71.9% had primary infertility and 28.1% secondary infertility. The average (mean±SD) sperm concentration, total motility, dead and morphologically normal sperm in all the participants were 47.51±37.5 million/ml, 46.96±22.8, 27.18±17.9, and 65.77±35.4 respectively. Of these 34.2% male infertility cases, the most common abnormality detected on semen analysis was a combination of abnormalities (25.6%) [OATS, oligoasthenozoospermia, oligonecrospermia], followed by azoospermia (23.07%), oligozoopsermia (17.9%), and teratozoopsermia (17.9%). In the present study, no significant correlation was found between male partner's age, occupation, religion, duration, and type of infertility with semen parameters including sperm concentration, motility, vitality, and morphology. A significant inverse correlation was observed between sperm motility and male partner's BMI and personal addiction history. A similar study conducted to know the impact of age, occupation, and lifestyle behaviors on semen parameters of infertile males, reported azoospermia (33.3%) as the most common semen abnormality followed by oligozoospermia. They also reported that the male partner's occupation, addiction, and age, significantly affect the semen quality, especially sperm motility and vitality with the least impact on sperm count [10]. A recent study also found no significant impact of male partner's age on various semen parameters. In their study, 67% of couples had primary infertility and 33% secondary infertility similar to ours. Furthermore, similar to our results they also found a weak correlation between male BMI and poor semen parameters [11]. Another study on infertile males from China also reported that male partners' aging does not lead to deterioration of semen parameters and quality [12]. A study on demographic and lifestyle association with semen quality of men with infertility reported that the mean age of participants was 34.44 ± 0.21 years with asthenozoospermia (30.09%) as the most common semen abnormality. In their study majority of participants were laborers (26.62%). Similar to our results they also observed decreased sperm motility and count among participants with a history of addictions [6]. There are mixed results about the impact of male BMI on semen parameters in infertile couples. Some studies similar to our results report an inverse correlation between BMI and semen parameters [13, 14], whereas others report no significant correlation between male BMI and sperm concentration, motility, or vitality [15, 16]. Similar to our results many studies have reported reduced sperm motility, concentration, and viability with addiction like smoking, alcohol consumption, and tobacco chewing [17, 18]. Hence, various demographic features, occupations, lifestyle factors play a crucial role in male fertility. The present study found no significant correlation between male partner's age, occupation, religion, duration, and type of infertility with semen parameters, though a significant inverse correlation was observed between male partner's BMI, addiction, and sperm motility.

Limitation

The present study was conducted for a short duration and with very small sample size. Furthermore, parameters like sedentary lifestyle, faulty dietary habits, stress, environmental factors were not taken into consideration.

Conflict of Interest

The authors have no conflicts of interest.

Funding

None

Ethical issues

The present study was conducted after proper Institutional Ethical Committee, with IEC number -2020-21/31. Informed written consent was taken from all participants and every attempt was made to maintain their privacy.

Author Contribution

Naina Kumar: Concept, design, the definition of intellectual content, literature search, data acquisition, data analysis and compilation, manuscript preparation, manuscript editing, and manuscript review.

Amit Kant Singh: Definition of intellectual content, literature search, data acquisition, data analysis and compilation, manuscript preparation, manuscript editing, and manuscript review.

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