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Original Research Article

Patterns of semen analysis among men attending screening camp organized by a specialty reproductive health institution: a retrospective observational study

Chandru R.[1], Ajay K. Adusumilli[2]*, Viresh G. Bali[1], Bandi Nagalakshmi[1], Narasimha Murthy[1], Arpitha Jathan[1]

[1]Department of Andrology, GarbhaGudi IVF Centre, Bengaluru, Karnataka, India
[2]Department of Evidence Synthesis, coGuide Academy, Bengaluru, Karnataka, India

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***Correspondence:**
Dr. Ajay K. Adusumilli,
E-mail: adusumilli.ajay@gmail.com

ABSTRACT

Background: Male factors infertility alone account for 20-30% of infertility cases, but when combined with female factors or other factors, their overall contribution increases to approximately 50% of infertility cases globally. Semen analysis has a sensitivity of 89.6%. There is limited data on semen parameters in the general male population, as most studies focus on infertile couples. We aim to estimate the burden of semen abnormalities and their pattern among general population of men attending screening camps.
Methods: This is a retrospective study based on camp based medical records of a speciality reproductive center. A total of 421 individuals' data was obtained from the medical records. The semen analysis was done at the campsite by the experienced andrology team.
Results: The mean age observed was 35.39±6.36. The majority of the study population are of age 31 to 35 (31.59%). Nearly 40% (147) of individuals have abnormal sperm parameters. Commonly observed abnormalities are asthenozoospermia, oligoasthenoteratozoospermia, Severe oligo astheno teratozoospermia with 28.74%, 19.76, and 23.35, respectively. Azoospermia was observed in 16.77%. We found a statistically significant negative association between age and sperm concentration and motility (total and progressive) with $p<0.05$.
Conclusion: The sperm concentration was highest in the age group 31 to 40 years, but progressive and total motility declined significantly with increasing age. These trends suggest that male fertility subtly deteriorates even within a relatively young cohort.

Keywords: Male infertility, Seminal parameters, Azoospermia, Oligozoospermia

INTRODUCTION

The World Health Organization (WHO) reports that infertility is a critical global health concern, affecting approximately 17.5% of the adult population—equivalent to roughly 1 in 6 individuals worldwide.[1] WHO defines male infertility as the inability of a male to conceive a fertile female after engaging in regular, unprotected sexual activity for at least 12 months.[2] One of the main causes of male infertility is abnormalities in the sperm. Male factors alone account for 20-30% of infertility cases, but when combined with female factors or other factors, their overall contribution increases to approximately 50% of infertility cases globally.[3]

In India, studies showed that 20–30% of infertility cases are caused solely by male factors.[4] The primary assessment tool for determining male infertility is semen analysis. Males with sperm parameters below the WHO normal values are considered to have male factor infertility.[5]

The underlying causes that can influence the semen parameters include testicular failure, obstruction, cryptorchidism, low semen volume, sperm agglutination, idiopathic fertility varicocele, erectile or ejaculatory dysfunction, abnormal viscosity, endocrine disorder, high density of sperm, congenital abnormalities, and environmental causes.[6] These underlying conditions leading to male infertility will manifest as abnormalities in semen parameters, such as the quantity, concentration, quality, reflected by the shape and motility of sperm.

Semen analysis has a sensitivity of 89.6%, which can identify 9 out of 10 men who actually have a male infertility issue. This test provides valuable information about sperm count, motility, and morphology, which are essential for evaluating testicular function and guiding further diagnostic steps.[4,7] Recent researches have shown that the semen parameters and overall testicular function may represent as markers of general health.[8,9]

An increasing amount of research suggests that male infertility raises the risk of oncologic, cardiovascular, metabolic, and autoimmune diseases.[10] Consequently, prompt detection and treatment of medical issues impacting not just fertility but also the overall well-being of patients are made possible by early diagnosis of male infertility.

Though there are multiple studies available on semen parameters and their influencing factors among infertile couples. Despite this, there is limited data on semen parameters in the general male population, as most studies focus on infertile couples. Understanding of the true burden and profile of semen abnormalities can help clinicians, policymakers, and other stakeholders in designing appropriate interventions to address modifiable behavioural risk factors. Hence, the current study is aimed at estimating the burden of semen abnormalities and their pattern among the general population of men attending education and screening camps organized by a specialty reproductive medicine institution.

METHODS

Study design

This was a retrospective observational study conducted by analysis of electronic hospital records.

Study setting

The study was carried out at a tertiary care specialty reproductive medicine centre. Data were derived from male screening camps organized by the centre as part of routine reproductive health evaluation services.

Study period

Data were collected from screening camps conducted between January 2023 and October 2024. The study protocol was finalized and initiated after receipt of ethical approval.

Study population

The study population comprised men who attended the screening camps during the study period.

Inclusion criteria

Men aged 21 to 55 years, participants who attended the screening camps during the study period and participants who reported sexual abstinence for 3–7 days prior to semen sample collection were included.

Exclusion criteria

Participants with incomplete records or those who did not meet the abstinence criteria were excluded from the analysis.

Data collection methods

The samples were collected via masturbation into sterile, screw-capped plastic universal containers. Key information, such as age, abstinence period, and collection details, was recorded. The semen analysis parameters included were volume, concentration, and motility. Seminal morphology was evaluated by trained personnel. Data were entered into a pre-designed case record form (CRF) using the coGuide REAP platform.

Study variables

The primary variables analyzed were semen volume, sperm concentration, motility, and morphology. Demographic variables included participant age and abstinence period.

Statistical analysis

Descriptive statistics were used to summarize the data. Categorical variables were presented as frequencies and proportions, while continuous variables were summarized as mean±standard deviation (SD) or median with interquartile range (IQR), as appropriate. The Chi-square test was used to assess associations between categorical variables. The Kruskal–Wallis H test was applied to compare non-normally distributed continuous variables across more than two groups. A $p<0.05$ was considered statistically significant. Data was analysed by using coGuide REAP software version 2.0, V.1.0.[11]

Ethical considerations

The study was conducted in accordance with the ethical standards laid down in the Declaration of Helsinki. Approval for the study was obtained from the Institutional Ethics Committee prior to initiation (Approval No. 24/GRB 02/V05, dated 29 March 2025). As this was a

retrospective analysis of anonymized data collected during routine screening, individual informed consent was waived by the ethics committee.

RESULTS

The study included adult males aged between 21 and 55 years who attended fertility screening camps organized by a tertiary care reproductive medicine center. The mean age of the participants was 35.39±6.36 years. Among the participants, the majority were in the age groups of 31–35 years (31.59%) and 36-40 years (27.08%). The least participants were in the age group of 21–25 years (4.15%). The mean abstinence period before semen collection was 4.49±4.65 days, as per Table 1.

According to Table 2, semen parameters revealed a mean semen volume of 2.26±2.40 ml. The mean sperm concentration was 44.31±35.27 million/ml. The mean total motility was 49.32±25.22%, with progressive motility accounting for 37.58±22.46% and non-progressive motility for 11.98±6.31%. The mean percentage of immotile sperm was 40.69±23.56%. These findings indicate a wide variation in semen quality across the study population.

Analysis of semen abnormalities revealed that most of the participants, i.e., 60.33% had normozoospermia, meaning all semen parameters were within normal reference ranges. The remaining exhibited abnormalities.

Asthenozoospermia was observed in 28.74% of participants, followed by severe oligoasthenoteratozoospermia in 23.35%, oligoasthenoteratozoospermia in 19.76%, azoospermia in 16.77% and oligozoospermia in 9.58%. 1.80% participants had other seminal abnormalities like cryptozoospermia, as per Table 3.

Table 1: Demographic characteristics.

Characteristics	Parameter	Summary
Age (in years)	Age in years (mean±SD)	35.39±6.36
	Abstinence (days) (mean±SD)	4.49±4.65
Age groups (n=421), N (%)	21–25	19 (4.15)
	26–30	77 (18.29)
	31–35	133 (31.59)
	36–40	114 (27.08)
	>40	78 (18.53)

Table 2: Semen parameters (descriptive statistics).

Semen parameter	Mean±SD
Semen volume (ml)	2.26±2.40
Sperm concentration (million/ml)	44.31±35.27
Total motility (%)	49.32±25.22
Progressive motility (%)	37.58±22.46
Non-progressive motility (%)	11.98±6.31
Immotile sperm (%)	40.69±23.56

Table 3: Seminal abnormalities distribution (n=421).

Characteristics		Frequency	Percentage (%)
Seminal parameter	Normozoospermia	254	60.33
	Abnormal seminal parameters	167	39.67
Abnormal (n=167)	Azoospermia	28	16.77
	Oligozoospermia	16	9.58
	Asthenozoospermia	48	28.74
	Oligoasthenoteratozoospermia	33	19.76
	Severe oligoasthenoteratozoospermia	39	23.35
	Others	03	1.80

Correlation analysis between age and semen parameters showed a statistically significant negative correlation between age and progressive motility (r=–0.098, p=0.045) and total motility (r=–0.103, p=0.035), suggesting a decline in progressive and total motility with increasing age. No statistically significant correlation was observed between age and other semen parameters, including sperm concentration (r=–0.033, p=0.505), non-progressive motility (r=–0.088, p=0.072), immotile sperm (r=0.095, p=0.052), semen volume (r=–0.030, p=0.539), these findings highlight that while some semen characteristics remain relatively stable, motility may be particularly vulnerable to age-related decline. The results are shown in Table 4.

Table 4: Correlation between age and semen parameters.

Correlation between age versus semen parameter	r	P value
Sperm concentration	–0.033	0.505
Total motility	–0.103	0.035
Progressive motility	–0.098	0.045
Non-progressive motility	–0.088	0.072
Immotile sperm	0.095	0.052
Semen volume	–0.030	0.539

There was a statistically significant difference in median sperm concentration in millions per ml, total motility in

percentage, progressive motility in percentage, and non-progressive motility in percentage among age groups ($p<0.05$). With an increase in age, all the parameters showed improvement till the age of 40 years. In the age group of 40 and above, sperm concentration, progressive motility, non-progressive motility, and total motility were decreasing. However, there was a statistically insignificant difference in median semen volume in ml and immotile sperm percentage among age groups ($p>0.05$). The results are presented in Table 5. Adjusted Bonferroni correction showed that the median total motility in percentage and progressive motility in percentage was found to be higher among 36 to 40-year-olds compared to those 41 and above.

Table 5: Comparison of sperm parameters according to age groups.

Parameters	Age groups (median, IQR)					P value
	Upto 25 (n=19)	26 to 30 (n=77)	31 to 35 (n=133)	36 to 40 (n=114)	41 and above (n=78)	
Semen volume in ml	1.5 (1.1,2.2)	2 (1.2,2.5)	2 (1.5,3)	2.05 (1.3,2.8)	2 (1.4,3)	0.283
Sperm concentration in millions per ml	25 (7.5,32)	42 (22,72)	45 (16,66)	45 (12,74)	24.5 (7,61)	0.011
Total motility in percentage	43 (17.5,59)	57 (45,78)	52 (35,68)	58 (39,73)	43 (25,62)	0.003
Progressive motility in percentage	30 (8.5,47.5)	42 (32,63)	38 (22,53)	40 (25,57)	30 (17,47)	0.007
Non progressive motility in percentage	10 (8,13.5)	12 (10,16)	13 (10,16)	13 (10,15)	11.5 (6,14)	0.043
Immotile sperm in percentage	42 (23.5,58.5)	36 (20,48)	40 (25,56)	41 (27,58)	45 (25,62)	0.168

DISCUSSION

This was a retrospective study in which we had included 421 male participants of age between 21 to 55 years. The mean age of the participants was 35.39±6.36. The mean abstinence period before semen collection was 4.49±4.65 days. Our study findings indicate a wide variation in semen quality across the study population. Semen sample of 60.33% of the participants fell within in normal range. However, significant proportion of abnormalities like athenozoospermia, Severe oligoasthenoteratozoospermia, and oligoasthenoteratozoospermia were observed. Our findings show that some semen characteristics remain relatively stable, but motility may be particularly vulnerable to age-related decline.

The most common semen abnormalities observed in our study were asthenozoospermia (28.74%), severe oligoasthenoteratozoospermia (23.25%), oligoasthenoteratozoospermia (19.76%), azoospermia (16.77%), and oligozoospermia (9.58%). These findings are consistent with the findings of the previous studies like Joshi et al, where most of the participants (72%) were in the age group of 20-35 years. Among these 11% were azoospermic, 36% were oligospermic, 26% were diagnosed with asthenospermia and 28% were diagnosed with Teratozoospermia.[12] Adeniji et al, also reported similar results with most common semen abnormality as asthenozoospermia (27.8%) and azoospermia (6.7%).[13]

In our study, the sperm concentration observed was 44.31±35.27, which is in contrast to previous findings. The previous studies have reported the mean sperm concentration as 66.20±34.90 million/ml, and in another study, a median sperm concentration of 63.8×106 cells/ml. This variation in the semen concentration can be attributed to a larger proportion of samples representing a younger age group compared to our study. Notably, Zabihullah et al also reported a statistically significant positive correlation between age and semen concentration ($p<0.013$), which is negatively associated in our findings.[14,15] Semen concentration in our study showed an upward trend across age groups. Rising from 25 million/ml in less than 25 years to 42 million/ml in 25 to 30 years age group, it further increased to 44 million/ml in the age groups of 31 to 35 and 35 to 40 years before declining slightly to 42 million/ml in individuals over 40 years of age. Few studies have reported a decline in concentration with age while a few studies reported similar findings with more than 40 million per ml in all similar age groups.[14,16,17] Previous research has reported that advancing age in males is associated with a decline in serum testosterone levels and a concomitant elevation in circulating follicle-stimulating hormone (FSH), both of which are implicated in the attenuation of spermatogenic function.[18] Additionally, advanced paternal age is associated with exacerbation of oxidative stress, which in turn contributes to DNA fragmentation within spermatozoa, thereby adversely affecting semen.[19]

Furthermore, lifestyle factors like alcohol, smoking, and obesity will augment the above mechanisms or will directly impact the semen concentration in ageing males.[20]

The total motility and progressive motility were decreasing with advancing age in this current study, with statistical significance $p<0.05$. These findings are consistent with the previous studies.[14,15] The trends in total motility were surging up in the age groups of less than 25 to 40 years, with the motility ranging from 43 % to 58%

and then the motility declined to 43% in the age groups of above 40 years. These observations are found to be similar to other studies done on large sample of 1523 participants and another study which reported a decline in motility with advancing age.[17,21] This decline in motility can be attributed to the changes in the epididymis of the testes, where spermatozoa will mature and gain motility.[22]

The strength of our study is that we have included a well-defined study population with a reasonably broad age distribution, enabling meaningful subgroup comparisons. The inclusion of multiple semen parameters adds depth and relevance while comparing with prior studies. There are a few limitations of this study, such as a cross-sectional design, which prevents assessment of individual longitudinal changes in semen quality. Relatively small sample sizes in some age groups may limit generalizability, especially for older groups. Owing to a lack of resources and diagnostic infrastructure at the camp site, we could not examine morphological patterns of the semen.

CONCLUSION

Our study shows that while sperm concentration was highest in the age group 31 to 40 years, but progressive and total motility declined significantly with increasing age. The most common abnormalities found were asthenozoospermia. severe oligoasthenoteratozoospermia, oligoasthenoteratozoospermia, and azoospermia.

These trends suggest that male fertility subtly deteriorates even within a relatively young cohort. There is a need to conduct a prospective observational study to track changes within individuals over time, incorporating factors like lifestyle and diet.

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