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## Evaluation of the infertile male: Is conventional semen analysis relevant in the 21<sup>st</sup> Century?

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### Abstract

**Background:** Infertility is defined by the failure to achieve a clinical pregnancy after 12 months or more of regular unprotected sexual intercourse. The analysis of semen remains the key element in the evaluation of male reproductive potential in association with possible risk factors.

**Materials and Method:** This is an observational cross-sectional study where seminal fluids from 105 Male subjects were analyzed in the Central Diagnostic Laboratory, Shree Krishna Hospital and Pramukh Swami Medical College, Karamsad during January 2019 to July 2020 using the World Health Organization (WHO) 2010 criteria for human semen characteristics.

**Results:** The present study included subjects with a mean age of 30.9 years. Analysis divided them into oligospermia 22 cases [20.9%], normospermia 47 cases [44.7%] and azospermia 6 cases [5.71%].

**Conclusions:** Summarized from our study, a good number of males would yield a normal semen analysis, even though suffering from infertility. Hence, a normal report of semen analysis cannot guarantee the fertilization potential of sperm.

**Keywords:** Clinical pregnancy, 21st Century, conventional semen

### Introduction

The definition of infertility, as given by WHO and the American Society for Reproduction Medicine Practice Committee, means no conception after at least 12 months of unprotected sexual intercourse <sup>[1]</sup>. Approximately 40–50% infertility cases are due to “male factor” infertility. Various causes are responsible for infertility and it is proved that infertility is due to many factors, in both male and female. Obesity, occupational exposure, alcohol, smoking, stress, wearing tight fitting clothes, and exposure to therapeutic drugs are considered as risk factors of male infertility. Disorders that may require specific surgical or medical intervention include varicocele, endocrinal disorders, reproductive tract infections, ejaculatory disorders, anti-sperm antibodies, genetic mutation and chromosomal abnormalities <sup>[2]</sup>. The fertility potential of a male is evaluated by a semen analysis and qualitative and quantitative changes are used as an indication of the reproductive potential.

Semen analysis is an easy test that assesses the formation and maturity of sperm and their interaction with the other fluids in semen. Hence, it provides an insight into, not only the sperm production (count), but also the sperm quality (motility, morphology). Currently, routine semen analysis remains the backbone of the evaluation of male factor infertility, along with detailed medical history and thorough physical examination. This relies on the fact that the semen parameters such as sperm concentration, motility, and morphology are significantly associated with conception<sup>1</sup>. Hence, In spite of the many limitations of semen analysis it is still performed in laboratories all over the world.

### Aims and Objectives

The present study is undertaken to assess and analyze the semen characteristics of all the males who presented to our hospital, irrespective of primary or secondary infertility.

### Materials and methods

The present study is an observational cross sectional study done at Central diagnostic laboratory of Shree Krishna Hospital and Pramukh Swami Medical College, Karamsad for samples received in the Clinical Pathology section between January 2019 to July 2020.

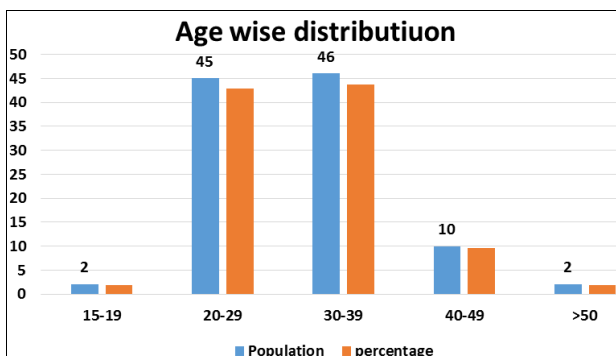
The study population comprised of 105 male patients referred to the Central diagnostic laboratory for semen analysis. The samples were collected after providing proper instructions regarding semen collection. Samples were collected after a minimum of 3 days of abstinence but no longer than 7 days. Semen assessment was performed as per the World Health Organization's manual on semen analysis; as soon as the samples were liquefied but within 1 hour of collection. Seminal volume was measured while sperm count was done in the haemocytometer (Improved Neubauer counting chamber) after an appropriate dilution. Sperm motility was assessed by visualization of a wet mount smear under the microscope. For morphology smears made on clean slides were fixed, stained with the Giemsa stain and analyzed on light microscopy.

**Results and observations**

The present study is an observational cross-sectional study of 105 subjects whose age ranged from 17 years to 45 years. The maximum number of cases were in the age range 30-39 years accounting for 43.8% (n=46) of the cases, the mean age being 30.9 years. Keeping in view the latest WHO recommendations, 1.5ml or more was taken as normal volume. Out of the 105 subjects in the current study, 47 individuals (44.75%) had an ejaculate volume less than 1.5 ml. 58 individuals (55.23%) had an ejaculate volume of 1.5 ml and above.

**Table 1:** Distribution of cases according to volume of semen (n=105)

Volume of semen in ml	Number of males (%)
<1.0	4 (3.80%)
1-1.4	43 (40.95%)
1.5-1.9	25 (23.8%)
2.0 or >2.0	33 (31.42%)



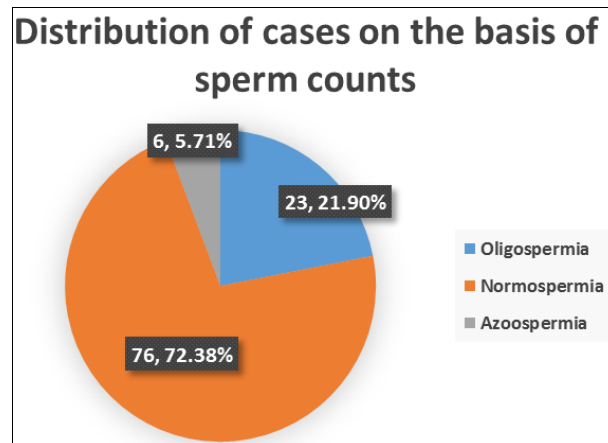
**Fig 1:** Demographic distribution of individuals

It is well known that sperm concentration is predictors of fertility potential. The sperm counts in the present study ranged from 0-148 million per ml out of this 27.61% (29) of the cases had a sperm concentration of less than 15 million/ml and a total of 72.38% (76) of the analyzed population was in the normal range. Azoospermia, that is no sperms in the ejaculate, was seen in 6 (5.71%) individuals. These cases were also distributed based on age group and sperm count. Oligospermia were cases with counts less than 15 million/ml, Normospermia was those with sperm counts above 15million/ml while azoospermia had no sperms. Besides sperm concentration, sperm motility is additionally a crucial parameter and determinant of male fertility. It is important to understand that sperm motility should be analyzed as early as possible and must be measured within hour of collection. Consistent with the

newest WHO criteria a complete sperm motility of 40% with progressive movement of >32% is taken as stop value, individuals above this are taken to be normal. Within the present study, 68.50% of the cases were above the reference motility and each cases had > 32% of sperms with progressive movement. 31.40% of the cases were less motile. Six cases out of the 33 cases in present study had 100% dead sperms at the time of evaluation.

**Table 2:** Distribution of cases on the basis of total motility (n=105)

Motility	Number	Percentage
Below reference limit	33	31.40%
Above reference limit	72	68.50%

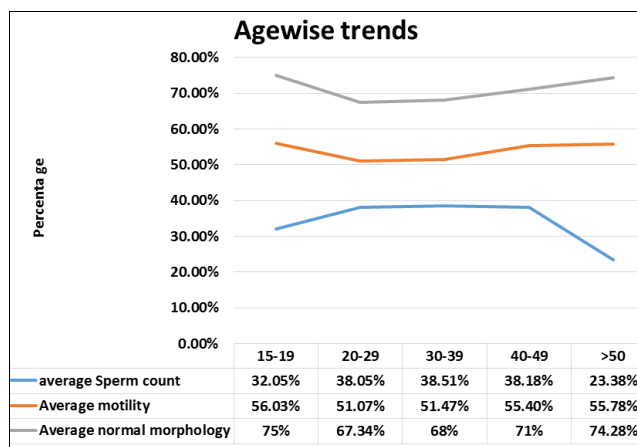


**Fig 2:** Distribution of cases on the basis of sperm counts

The morphology was assessed on fixed stained smears of the semen samples in the current study population 5.71% (6 individuals) had no sperms in the ejaculate (azoospermia). 91.42% were in the normal range with a mean normal morphology of 72.29%. Any defects of head, neck, mid piece and tail were considered as abnormal morphology.

**Table 3:** Distribution of cases on the basis of normal morphology (n=105)

Morphology	Number	Percentage
Below reference range	9	8.57%
Above reference range	96	91.42%



**Fig 3:** Age wise representation of average sperm parameters

An age specific comparative analysis of the mean sperm counts revealed a mild increase in the average sperm count

up from 15-19 years of age group to 40-49 years of age group following which a decline is noted. Total motility and normal morphology revealed same curve with decline in initial age group till 20-29 and then relative increase values.

### Discussion

Our study was an observational cross sectional study with a population of 105 individuals having a mean age of 30.9 years with a maximum number of cases were in the age range 30-39 years. A relatively higher mean age of 36.8 years and 34 years has been reported by other authors<sup>3, 4</sup>. However, a mean age of 30 years in concordance with our finding was observed by Jajoo S. *et al.*<sup>[5]</sup>

Ejaculated seminal volume is a parameter that reflects abnormalities in accessory sex glands fluid synthesis i.e. seminal vesicle. It can also be indicative of a physical obstruction somewhere in the reproductive tract or in cases of incomplete retrograde ejaculation.<sup>5</sup> According to the latest WHO recommendations, the lower reference value for semen volume is 1.5ml<sup>6</sup>, with reference to this 44.75% of our study population had low volume while the remaining was within the normal range. More so, had the WHO (1999)<sup>[7]</sup> criteria of 2ml and above been applied, only 31.42% would have been considered normal similar to the Punjab study by Butt *et al.*<sup>[8]</sup>, 74.24% of the population had normal semen volume.

Sperm concentration are often proposed to be predictors of fertility potential. In recent years there have been reports of declining sperm concentration in men around the world. The new WHO 2010 guidelines has taken lower reference limit of 15 million/ml with values above these taken as normal<sup>6</sup>, Oligospermia (sperm counts <15 million/ml) in the present study was seen in 21.90% of the cases while lower rates are observed in other study 17% by Jayrajpuri ZS *et al.*<sup>[9]</sup> It has been suggested by authors that low sperm counts are among the most common cause of male infertility.

Azoospermia, defined as absence of spermatozoa in the ejaculation was seen in 5.71% of the cases which was lower compared to those seen in other study such as 9%. The problem of azoospermia is thought to be associated with sperm production or sperm transport.

72.38% (76) of the analyzed subjects had normal sperm counts, in concordance with 74% reported by Jayrajpuri ZS *et al.*<sup>[9]</sup> More so, it may be noted that normal semen counts are a common event in infertile males, where the cause may be other factors such as immune related and marked biological variation.

As per the WHO 2010 recommendations, samples having 40% motile sperms with 32% showing progressive motility are considered normal<sup>6</sup>. In previous editions the total progressive motility for normal range was 50% and above; which included 25% with rapid progressive motility. In the present study 68.5% of the cases were above the reference motility and all these cases had > 32% of sperms with progressive movement. This was lower as compared to 77.9% reported in other study.

The WHO criteria for morphology has seen a marked change over the years from 50 % and above to as low as 4% in the 5th edition. Teratozoospermia has a deleterious effect on the rate of fertilization. The mean normal morphology in our study was 91.42% which was higher as compared to 65% reported to Butt *et al.*<sup>[8]</sup> Age related changes on the seminal parameters were also evaluated in our study, it was

noted that An age specific comparative analysis of the mean sperm counts revealed increase in count up to 40-49 years of age group following a decline in later age group. Total motility and normal morphology revealed same curve with decline in initial age group till 20-29 and then relative increase values. Results were compared to another study by Jayrajpuri ZS *et al.*<sup>[9]</sup> Which has evaluated a decline in the curve with the age.

### Conclusion

A high-quality basic semen analysis is the cornerstone of investigations related to infertile couple but it is important to acknowledge the limitation of semen analysis with respect to collection, processing, evaluation, biological variation of the parameters and lack of information on sperm function. The conventional semen parameters, such as sperm concentration, motility and morphology, are markers of male reproductive function. However due to limitations as above, a normal semen analysis does not guarantee the fertilization potential of sperm.

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