

Perspective Article

Semen Analysis - A Numbers Game

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Semen Analysis, despite its limitations, remains the single most important test for evaluating male fertility. However, the test is prone for errors at all levels of its performance.

There could be collection artifact, performance artifact or reporting artifact. Semen collection which looks like an apparently simple act, is fraught with many difficulties for infertile men and impossible for other infertile men. Since the discovery of the spermatazoa by the Dutch microscopist, Antonie van Leeuwenhoek in 1677A.D¹ several methods have evolved to estimate a semen sample^{2,3}. Several parameters have been described in a semen sample. However all these parameters have not yet been standardized and the values differ in different populations.

The WHO has published five editions of the manual for semen analysis at different times. The standards & reference value for different parameters have been redefined with each subsequent new edition. The first four editions were based on 'Consensus from experts.' and not on evidence based data. While consensus is suitable for social situations, consensus is bad for science. The current edition⁴ – Fifth Edition has redefined many of the values based on multicentric study; however, the manual does not take into account the ethnic differences (e.g. not involving Indians), many men previously considered to be Oligo, Astheno, Terato Zoospermia are now considered to be normal. Table 1.

Parameter	WHO 1987 (2 nd edition)	WHO 1992 (3 rd edition)	WHO 1999 (4 th edition)	WHO 2010 (5 th edition)
Volume	2.0 ml & above	2.0 ml & above	2.0 ml & above	1.5 ml & above
Sperm Concentration (million/ml)	20 million & above	20 million & above	20 million & above	15 million & above
Total sperm number (million/ejaculate)	40 million & above	40 million & above	40 million & above	39 million & above
Motility	50%(A+B) & above, 25% or more with Rapid progressive	50%(A+B) & above, 25% or more with Rapid progressive	50%(A+B) & above, 25% or more with Rapid progressive	40% (PR-32%)
Morphology	50 % & above	30% & above	15% & above	4%
Vitality	----	75% & above	50 % & above	58% & above

Table 1. WHO reference values over the years.

Like all other biological parameters, semen parameters also vary hugely from time to time in the same individual. The huge variation in a man’s semen parameters over time is beautifully depicted in the enclosed figure (Fig 1). However unlike other biological parameters, there is no lower limit (below which pregnancy is not possible) or there is no upper limit above which pregnancy is always possible. With no definable lower or upper limit, semen analysis seems to be a numbers game.

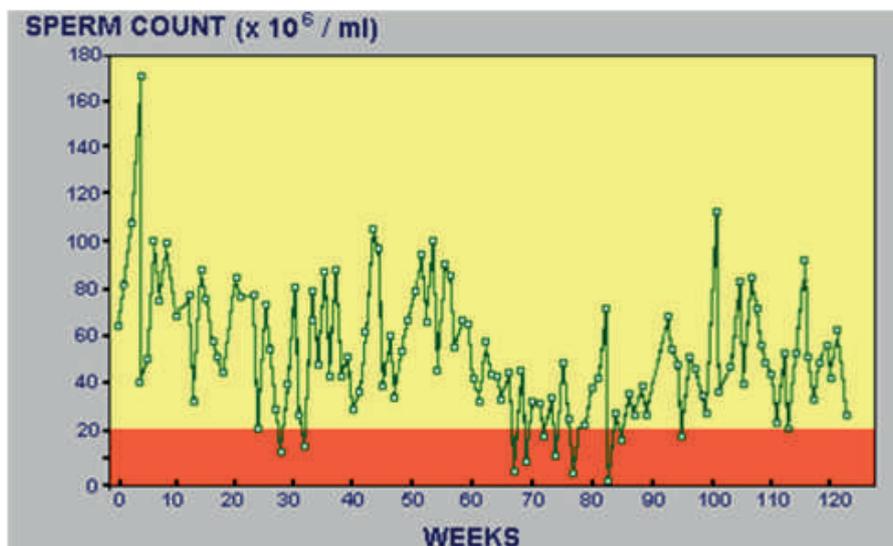


Fig 1. Variation in sperm concentration over time in a single individual (from WHO)

The spermatozoa concentration which varies hugely looks more like the stock market fluctuation. This variation not understood by the patients and the treating physicians, causes lots of anxiety and concerns for the patients and the physicians. We have also observed that the other semen variables like motility and morphology vary from time to time in the same individual (Fig 2).

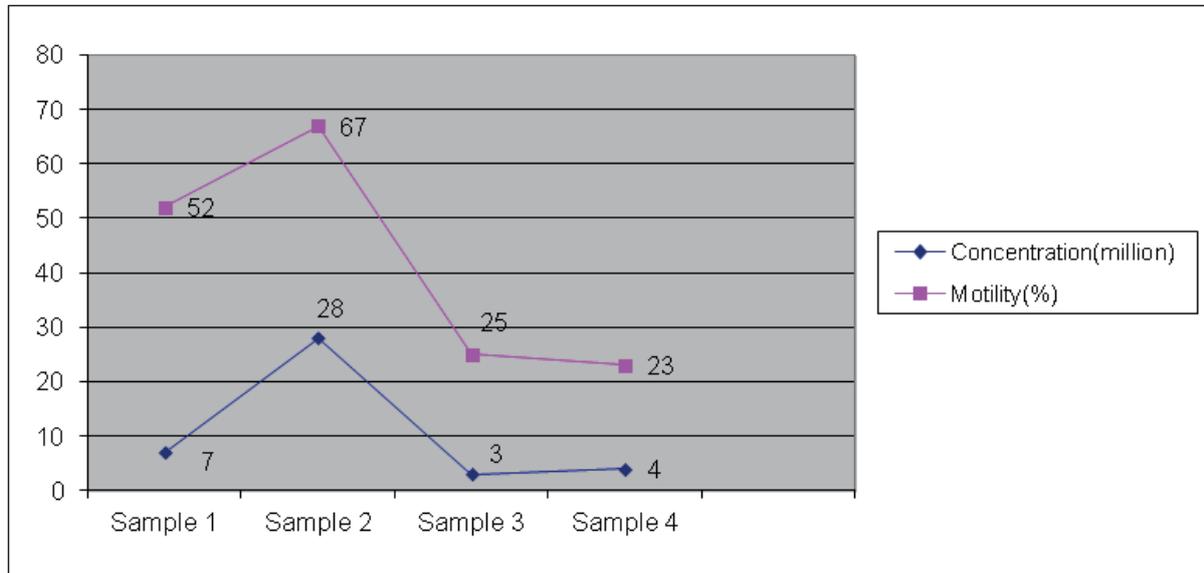


Fig 2. Variation in sperm concentration and motility over time

The fertility is the sum total of two peoples fertility as opposed to one person’s alone. Therefore the values of one person’s semen parameters is of little significance except in the extremes as when the sample is azoospermic or totally asthenozoospermic or totally necrozoospermic. Total asthenozoospermia and total necrozoospermia are very rare conditions. Many men have been subjected to the several forms of medical therapy and surgical therapy such as varicocelectomy based on previous WHO semen parameters. Therefore it is possible that men may have been subjected to unnecessary medical/surgical treatment as a consequence of potentially inaccurate diagnostic criteria.

Today we suggest that semen parameters need to be redefined for the individual population. We propose that after decades of experience from full time infertility work that, even today, semen analysis remains largely subjective and not as objective as it needs to be. We have been dealing with parameters such as volume, concentration, motility & morphology without knowing what is “normal”. Doubts have been raised about the value of sperm counting more than 100 years back. In 1910, Benedict said "Enumeration of spermatozoa has seldom been practised. How useful either as an index of sexual or general health it is, is not yet known".²

The time is now ripe for us to carefully rethink and redefine normal semen parameters. Population based studies are essential to establish normal values. While WHO manual 5th edition may be a good starting point, it still needs further definition for each population.

References:

- 1) Van Leeuwenhoek A. Letter to Oldenburg dated 9 October 1676, Philosophical Transactions 1677; 12: 831.
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- 3) Macomber, D,- Sanders, M B. - The Spermatozoa Count - N Engl J Med 1929; 200:981-984
- 4) World Health Organization. WHO Laboratory Manual for the Examination and Processing of Human Semen, 5th ed. Geneva: World Health Organization; 2010.