# Sperm characteristics of men at different ages

## *Running Head: Sperm characteristics of men at different ages*

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## ABSTRACT

*Background: Knowledge regarding seminal fluid and spermatozoids in the elderly is controversial at best in the literature. The purpose of the present study was to analyze the relationship between male age and spermatozoid.*

*Methods: The sperms of 80 healthy adult men, between 21 and 60 years of age, were studied after three to five days of sexual abstinence. Volunteers were distributed into four age groups (n = 20): 21-30, 31-40, 41-50 and 51-60 years of age.*

*Results: No difference regarding the sperm's physical and chemical characteristics (smell, color, volume, viscosity and pH) was found. The spermatozoid's mobile forms showed no difference among the four groups. The concentration of spermatozoids proved to be higher in the semen of men of over 41 years of age, while in the 41 to 50 years of age group, the number of oval spermatozoids was higher (p = 0.03), with a less abnormal tapered form (p = 0.02) when compared to the other three groups.*

*Conclusion: More normal forms of spermatozoids are found between 41 and 50 years of age.*

**KEY WORDS**

*Spermatozoid, Sperm, Semen, Man, Age.*

## Introduction

*Investigations into the effect of male age on fertility have become increasingly important due to the general impression that elderly men have a reduced sex life, with a lower ejaculated volume, and their spermatozoid morphology and motility are not as normal as that found in young men. However, in studies comparing seminal characteristics of fertile fathers of over 60 years of age and those of less than 35 years of age, the older men showed a higher spermatozoid density with lower motility. The results of these papers presented no difference in either the seminal volume or the concentration of normal spermatozoid morphology [1,2,3,4,5]. Sperm deficiencies occur in 30% of infertile men [3,6,7,8].*

*Some studies have reported a reduction in the daily spermatogenesis in aging groups. This condition is associated with an increase in serum gonadotrophin and a drop in testosterone levels [1,8,9,10,11]. Testicular biopsies and the radioimmunoassay of the gonadotrophic hormone indicate a lower Sertoli cells function, less cytoplasm in the Leydig cells, as well as diminished and thickened lamina propria of seminiferous tubules [5,8,10,11,12,13,14].*

*Although semen quality seems to decline with age in elderly men, spermatozoid characteristics remain normal, according to World Health Organization (WHO) standards [1,2,4,16,17]. In cases of infertility, the aging effect on the quantity of semen can be significant enough to impact the sperm function [3]. The reduction in semen quality, along with a reduced sex life, may have a negative effect on a couple's fertility [3,5].*

*Due to scarce and controversial data concerning semen related with age, the present study sought to assess sperm characteristics at different ages in an attempt to analyze the relationship between male age and spermatozoid forms.*

## Methods

*This study was performed according to the Helsinki Declaration and was approved by the Committee of Ethics*

*in Research of the Federal University of Minas Gerais, Brazil, under protocol number 0429/15. All volunteers agreed to participate in this investigation, and signed the Informed Consent Form.*

*The semen of 80 healthy men, between 21 and 60 years of age, were studied after three to five days of sexual abstinence. This period was established based on the New 2010 WHO Standards (5th edition) for the Evaluation of Human Semen recommendations [2,15,16,17,18]. Volunteers were distributed into four age groups (n = 20): 21 to 30 (23 ± 5), 31 to 40 (33 ± 4), 41 to 50 (45 ± 2) and 51 to 60 (58 ± 3) years of age.*

*The volunteers were selected by directed anamnesis referring to sexual background (frequency of sexual activity, erectile or ejaculation disorders and previous paternity). Men with previous urological disease or endocrine disorders, such as diabetes mellitus; those using any drug; those who were infertile or with a family history of infertility; or those presenting any other sexual disturbance were not included in this study. The presence of leukocytospermia in the sperm specimen excluded the patient from this investigation.*

*A single specimen of sperm from each volunteer was collected into a sterile flask, which was immediately hermetically closed. Volume, aspect, odor, viscosity and pH of the seminal fluid were assessed immediately after sperm harvesting. The microscopic characteristics of the spermatozoids were defined approximately one hour later, the characterization of which included total motility at room temperature of 26 ºC and morphological aspects.*

*After diluting the semen in 1:20 solution (0.1 mL sperm in 1.9 mL of a 0.9% saline solution), sperm cells were counted in a Neubauer chamber by using an optical binocular microscope. The counts of the morphologic spermatozoa were done blindy and included the five chamber quadrants; the four lateral quadrants, used in hematology for leukocytes counts; plus the central area, used for erythrocyte counts. The total spermatozoid counts were multiplied by one million to obtain the exact number of spermatozoids per mL. According to morphology, spermatozoids were classified as normal (oval) or abnormal (tapered, round, amorphous, immature, double-headed, double-tailed, macrocephalic or microcephalic) [3,14,16]*

*The descriptive method for the mean and the standard error of the mean (SEM) was used for statistical analysis. Results were compared using the analysis of variance (ANOVA), followed by the Tukey-Kramer test for multiple comparisons. Bonferroni correction was applied to ANOVA. Differences were considered significant for values amounting to $p < 0.05$.*

## Results

*No difference in semen volume, sperm concentration or sperm morphology was observed among the groups. No difference was found among sui generis smell, light gray color, viscosity within the normality limits and pH = 7. The ejaculated volume varied between 2.0 and 3.2 (mean = 2.5 ± 0.2) mL. A higher concentration of spermatozoids was found in the two groups of over 41 years of age when compared to the other two groups. (Table 1). No sperm specimen with leukocytospermia was found in this study.*

*The microscopic analysis one hour after seminal fluid harvesting identified a similar percentage of mobile spermatozoids in the four groups (Table 1). However, the normal oval spermatozoids were more frequent in the group of 41 to 50 years of age when compared to the other three groups ($p = 0.03$). Abnormal spermatozoids were less frequent between 41 and 50 years of age than in the other age groups ($p = 0.02$) (Table 2). Plasma membrane integrity was preserved in all spermatozoids of all cases.*

**Table 1 -** *Concentration of spermatozoids (mean ± standard deviation of mean) in the seminal fluid and percentage of spermatozoids with normal mobility*

| AGE GROUP | CONCENTRATION (X $10^6$ /mL) | % NORMAL MOBILITY |
|---|---|---|
| 1 - 30 years | 83 ± 49 | 70.0 |
| 31 - 40 years | 76 ± 46 | 69.1 |
| 41 - 50 years | 105 ± 49 | 76.7 |
| 51 - 60 years | 173 ± 25 | 75.4 |

**Table 2 –** *Morphologic characteristics (percentage) of spermatozoids according to age.*

| MORPHOLOGY | AGE GROUP (years old) | | | |
|---|---|---|---|---|
| | 21 - 30 | 31 - 40 | 41 - 50 | 51 - 60 |
| Oval | 27.8±4.4 | 28.2±6.3 | 38.0±8.1 * | 30.4±7.7 |
| Tapered | 24.4±3.1 | 23.7±5.0 | 16.1±4.1 ** | 21.3±6.5 |
| Round | 22.4±4.1 | 23.3±5.9 | 25.7±4.1 | 24.6±8.9 |
| Immature | 7.2±1.0 | 8.4±2.0 | 7.4±1.9 | 7.7±2.5 |
| Amorphous | 9.2±0.9 | 8.6±2.9 | 7.8±2.3 | 9.1±3.0 |
| Double-headed | 1.2±0.0 | 0.3±0.0 | 0.5±0.0 | - |
| Double-tailed | 0.7±0.0 | 0.4±0.0 | - | 4.6±1.0 |
| Macrocephalic | 4.7±0.4 | 3.6±0.6 | 2.0±0.1 | 2.3±0.2 |
| Microcephalic | 2.4±0.2 | 3.5±0.6 | 2.5±0.2 | - |

** : Higher percentage than in the other age groups (p = 0.03)*
*** : Lower percentage than in the other age groups (p = 0.02)*
*(ANOVA followed by Tukey-Kramer test for multiple comparisons).*

## Discussion

*Previous inconclusive and even inconsistent studies have reported that an increased male age is significantly associated with a decrease in semen volume, a decline in morphologically normal spermatozoa, as well as a reduction in progressive motility and sperm concentrations [1,2,4,15,16]. Semen quality is an indirect measure of fertility; however, the fertility of a given semen sample cannot be established with certainty. Some comparative studies with healthy subjects showed that spermatogenic capacity is higher after three to five days of sexual abstinence [2,3,15,16,18]. By contrast, more immature spermatozoids with lower motility have been described during shorter intervals. In the present study, the sperm from all volunteers was harvested after three to five days of sexual abstinence.*

*Atherosclerotic vascular disturbance is associated with an impairment in the testicular blood supply, causing parenchymal loss and sclerosis of the seminiferous tubules. This sequence of events is most commonly due to autoimmune inflammatory testicular atrophy, and has been described as a cause of reduction in spermatogenesis and a decrease in libido with advancing age [2,10,13,19,20]. Prostatic disorders are also related to a reduction in seminal fluid in elderly men [13,20]. Changes in the biochemistry of human semen have been reported with aging, showing decreases in the concentrations of fructose, kallikrein and prostate specific antigen (PSA), as well as raised liquefaction times. Recent studies have shown sperm DNA damage is significantly higher in older men [21,22]. These alterations could cause age-related declines in sperm motility and fertilizing ability [2,4,8].*

*In this study, no volunteer complained of any sexual abnormality and the seminal fluid presented normal physical and chemical characteristics. Furthermore, the concentration of a normal (oval) spermatozoid shape, considered ideal for fecundation, was higher in men over 41 years of age. No volunteers of 60 years of age or older were examined in this study due to the difficulty of finding men with no health disorder and who agreed to be included in this study. The analysis of the sperm motility at room temperature of 26ºC was not ideal. A lower temperature comparing with the 36ºC – 37ºC of the body environment could inhibit the motility, but the temperature was the same during the assessment of all spermatozoa, thereafter a possible error in results was constant for all groups.*

*The results of this work conflict with the data from prior literature regarding spermatozoid characteristics. According to these results, aging up to 60 years of age improves the aspect and motility of the spermatozoids with no negative influence on a man's seminal fluid. Additionally, the lowest rate of abnormal spermatozoid shapes found in men over 41 years of age suggests that they may in fact have a higher rate of fertility.*

## Conclusion

*More normal forms of spermatozoids are found between 41 and 50 years of age.*

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## Conflict of interests

*The authors declare no conflict of interest related to this study and its publication.*

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