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SPERM CHARACTERISTICS OF MEN AT DIFFERENT AGES

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ABSTRACT

Background: Knowledge regarding aging, seminal fluid, and spermatozoids is controversial in the literature. This study analyzed the relationship between male age and sperm characteristics.

Methods: Semen samples were collected from 80 healthy adult men aged between 21 and 60 years, following three to five days of sexual abstinence. Participants were divided into four age groups (n = 20 per group): 21 to 30, 31 to 40, 41 to 50, and 51 to 60 years.

Results: No significant differences were observed in sperm physical and chemical properties (smell, color, volume, viscosity, and pH), as well as motility across age groups. Sperm concentration was higher in men over 41 years. The 41 to 50 age group presented a higher proportion of normal (oval-shaped) sperm ($p = 0.03$) and a lower proportion of abnormal (tapered-shaped) sperm ($p = 0.02$) than other groups.

Conclusion: Men aged 41 to 50 years demonstrated a higher proportion of normal sperm shapes.

Keywords: Spermatozoid, Sperm, Semen, Man, Age.

INTRODUCTION

Research into the impact of male age on fertility has gained increasing attention due to the general perception that older men experience reduced sex life, including a lower ejaculate volume and diminished sperm morphology and motility than younger men. However, studies comparing the seminal characteristics of fertile men over 60 years of age with those under 35 have reported that older men may exhibit higher sperm density despite reduced motility. These studies found no significant difference in seminal volume or the concentration of morphologically normal sperm[1,2,3,4,5]. Additionally, sperm deficiencies occur in 30% of infertile men[3,6,7,8].

Several studies have reported a decline in daily spermatogenesis among aging men. This reduction is associated with elevated serum gonadotropin and decreased testosterone levels[1,8,9,10,11]. Testicular biopsies and radioimmuno assays of gonadotrophic hormones indicate diminished Sertoli cell function, reduced cytoplasm volume in Leydig cells, and diminished, thickened lamina propria in the seminiferous tubules[5,8,10,11,12,13,14].

Although semen quality appears to decline with age, sperm characteristics in older men remain within normal ranges, according to World Health Organization (WHO) standards[1,2,4,16,17]. However, in cases of infertility, aging can affect semen quantity and sperm function[3]. A reduced semen quality combined with reduced sexual activity may negatively affect the fertility potential of a couple[3,5].

Given the scarce and conflicting data on age-related changes in semen quality, this study evaluated the sperm characteristics across different age groups and the relationship between age and sperm forms.

METHODS

This study was conducted in accordance with the Helsinki Declaration and was approved by the research ethics committee of the Federal University of Minas Gerais, Brazil (no. 0429/15). All participants provided written informed consent before enrollment.

Semen samples were obtained from 80 healthy men aged between 21 and 60 years, following a period of three to five days of sexual abstinence. This abstinence period was established based on the recommendations of the New 2010 WHO Standards (5th edition) for the Evaluation of Human Semen [2,15,16,17,18]. Participants were divided into four age groups (n = 20 per group): 21 to 30 (mean 23 ± 5 years), 31 to 40 (33 ± 4 years), 41 to 50 (45 ± 2 years), and 51 to 60 (58 ± 3 years).

Participants were selected based on an anamnesis focused on sexual history, including frequency of sexual activity, erectile or ejaculation dysfunction, and previous paternity. Those with a history of urological or endocrine disorders, such as diabetes mellitus, use of any drug, known infertility or family history of infertility, leukocytospermia, and any other sexual dysfunction were excluded.

Each participant provided a single specimen

of sperm, collected in a sterile container that was immediately hermetically sealed. Seminal volume, aspect, odor, viscosity, and pH were assessed immediately after collection. Microscopic characteristics of the sperm were reported about one hour later, including total motility at room temperature of 26°C and morphological features.

Semen samples were diluted at a ratio of 1:20 (0.1 mL sperm in 1.9 mL of a 0.9% saline solution), and sperm cells were counted in a Neubauer chamber using a binocular optical microscope. Morphological evaluation was conducted blindly and included counts from five chamber quadrants: the four lateral quadrants (used for leukocyte counts) and the central area (used for erythrocyte counts). Total sperm counts were multiplied by one million to determine the exact number of spermatozoa per mL. Sperm morphology was classified as normal (oval) or abnormal (tapered, round, amorphous, immature, double-headed, double-tailed, macrocephalic, or microcephalic)[3,14,16].

Descriptive statistics were expressed as mean and the standard error of the mean (SEM). Comparisons among groups were performed using analysis of variance (ANOVA), followed by the Tukey-Kramer multiple comparison test. Bonferroni correction was applied to the ANOVA. Statistical significance was set at $p < 0.05$.

RESULTS

Semen volume, sperm concentration, or sperm morphology were not significantly different among the age groups. Similarly, no significant differences were found in sui generis smell, light gray color, viscosity within normal limits, or pH of 7. The ejaculated volume ranged from 2.0 to 3.2 (mean 2.5 ± 0.2) mL. Sperm concentration was higher in the two older age groups (41 to 50 and 51 to 60 years) than in the younger groups (21 to 30 and 31 to 40 years) (Table 1). No cases of leukocytospermia were identified.

Microscopic analysis revealed similar percentages of mobile sperm across all four age groups (Table 1). However, the 41 to 50 age group presented the highest percentage of normal oval sperms ($p = 0.03$), and the lowest percentage of abnormal sperms than the other age groups ($p = 0.02$) (Table 2). Plasma membrane integrity was preserved in all sperm across all samples.

Table 1. Sperm concentration (mean ± standard deviation) in the seminal fluid and percentage with normal mobility.

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

Table 2. Sperm morphologic characteristics (percentage) across age groups.

MORPHOLOGY	AGE GROUP (years)			
	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 conflicting studies have reported that increasing age is significantly associated with decreased semen volume, sperm concentrations, progressive motility, and the proportion of morphologically normal sperm[1,2,4,15,16]. Although the semen quality serves as an indirect measure of fertility, it cannot be used to predict the fertility of a given sample. Comparative studies with healthy individuals showed that spermatogenic capacity is higher after three to five days of sexual abstinence[2,3,15,16,18]. In contrast, shorter abstinence intervals have been associated with a higher proportion of immature sperm and reduced motility. In the present study, all sperm samples were collected after a standardized abstinence period of three to five days.

The atherosclerotic vascular disorder is associated with impaired testicular blood flow, leading to parenchymal loss and sclerosis of the seminiferous tubules. This process is often attributed to autoimmune inflammatory testicular atrophy and has been implicated in the cause of reduced spermatogenesis and libido with advancing age[2,10,13,19,20]. Additionally, prostatic disorders commonly observed in older men may contribute to a reduced seminal fluid[13,20]. Biochemical changes in human semen associated with aging have been reported, including decreased fructose concentrations, kallikrein, and prostate-specific antigen (PSA), as well as prolonged liquefaction times. Recent studies suggest that sperm DNA damage is significantly more prevalent in older men[21,22], contributing to reduced motility and fertilization capacity[2,4,8].

In this study, none of the participants reported any sexual dysfunction, and all seminal fluid presented normal physical and chemical characteristics. Furthermore, the concentration of normal (oval) sperm shape, considered ideal for fertilization, was higher in men aged over 41 years. No participants aged 60 years or older were included due to the difficulty in recruiting healthy men in this age group who agreed to participate. Sperm motility was assessed at a room temperature of 26ºC, which was lower than the physiological temperature of 36ºC to 37ºC. Although this suboptimal temperature may have inhibited motility, the uniform temperature testing conditions across all samples ensured that any potential measurement bias was consistent among the groups.

The findings of this study conflict with much of the existing literature regarding sperm characteristics. Our results suggest that, up to the age of 60, aging may be associated with improved sperm morphology and motility without a negative influence on seminal fluid characteristics. Additionally, the lower prevalence of abnormal sperm shapes observed in men over 41 years of age may indicate a relatively higher fertility potential in this age group.

CONCLUSION

Men aged between 41 and 50 years presented a higher proportion of morphologically normal sperms.

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CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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