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## The effect of varicocele on semen, sperm quality and DNA damage

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### Abstract

Varicocele is one of the most common causes of male infertility that can be treated by surgical intervention. The results of the study explained: The result shows a significant decrease in Sperm concentration, Percentage of sperm with progressive motility, Percentage of normal sperm morphology and Ejaculation time. The cause may be due to oxidative stress, which damages the DNA in the sperm, reducing its quality and ability to fertilize. Varicocele also affects sperm formation, and the study also showed a significant increase the level of 8-HoDG in patients with varicocele compared to the Normozoospermic group. It shows a significant increase in the protein value, which is an indicator of DNA damage, and the reason may be due to oxidative stress: it leads to damage to the DNA in the sperm, which reduces their quality and ability to fertilize.

**Keywords:** Varicocele, semen, sperm quality, DNA damage

### Introduction

Varicocele, a pathological dilatation of the spermatic veins in the scrotum, is one of the most well-known causes of male infertility, reportedly present in 15-20% of the general male population [1]. The condition is usually asymptomatic but significant deviations from normal are seen in semen parameters, sperm quality, and sperm DNA integrity, all of which may be associated with fertility problems. Various researches show that sperm production, motility, morphology and concentration, all important aspects of male fertility, are adversely influenced with varicocele [2]. In addition, there is growing evidence that varicocele is associated with increased DNA fragmentation of sperm cells possibly leading to adverse reproductive outcomes such as failed fertilization, early pregnancy loss, and congenital defects [3]. It is important to learn more about the molecular mechanisms underlying the effect of varicocele on sperm quality and DNA integrity so that we can develop better diagnostics and treatments for patients with varicocele. Due to higher heat dissipation, the testes is located on the scrotum, which is outside the body cavity, and the temperature of the testicles is also limited to 35-36 °C [4]. This mechanism of maintaining the temperature of the testicles is necessary for the spermatogenesis process and is regulated by the counter-current of the testicular arteries and veins where heat exchange occurs for the purpose of eliminating high temperatures [5]. One of the most frequent surgical treatable causes of male infertility is varicocele. It has been found that about 15–20% of men experience varicocele [6]. Indeed, 39% of the presence of varicocele is found in infertile males [7]. Some theories exist that could explain how this condition might impact male infertility. The cellular damage might be due to the hyperthermia which is an indirect damage as a result of venous congestion to the affected testicle which may lead to testicular dysfunction or partial occlusion of the passageways through which sperm pass through, or production of high level of nitric oxide, a substance that has other beneficial effects including vasodilatation effect on vasculature and other bodily functions, but the excessive production of it might result in damage to sperm or the varicocele may be led to a reduced oxygen supply to the sperm, which can also adversely affect spermatogenesis process [8, 9]. Some men with varicoceles were found to be fertile and others were infertile [10]. Objective: The goal of this study is to determine the impact of varicocele on semen quality and its correlation with DNA damage.

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**Materials and Methods**

**Sample Collection**

Samples were collected from the Infertility Center in Sadr Medical City during the period from 10/2/2024 to 1/2/2025. The samples collected were from people suffering from varicocele. The physiological analysis was performed by specialists and the genetic material was examined by ELISA.

**Results and Discussion**

These results demonstrate some of the connections between environmental and physical factors and sperm health, and point to some that influence patient factors leading to reduced sperm density and progressive motility, and its influence on the morphology of spermatozoa and ejaculation time. I am going to explain the whole scenario to you: Oxidative Stress: A state in which the number of free radicals, unstable entities that can potentially damage cells, becomes greater than the number of antioxidants present in the body. Oxidative stress can be damaging in the case of sperm too *viz-* it has the potential to harm the DNA present in the sperm, altering its quality and reproductive capacity. There are numerous studies that suggest the impact of

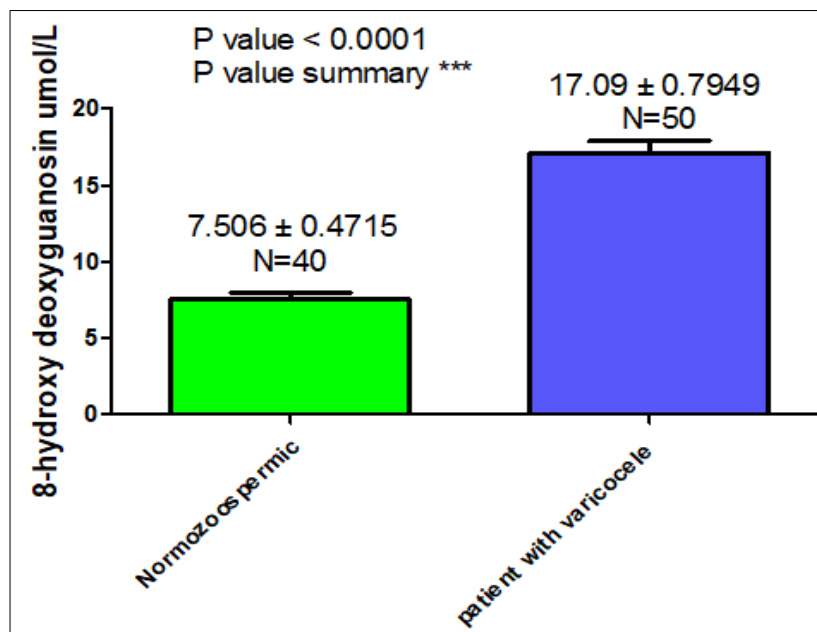
oxidative stress on male fertility, like an article published in Human Reproduction linking oxidative stress to poor fertility [11, 12].

Varicocele: A condition in which the veins that drain blood away from the testicle become enlarged, as well as reducing blood flow and oxygen to the testis. This leads to a rise in testicular temperature and accumulation of toxins that can adversely affect sperm production. Many studies have shown that varicocele reduces sperm quality due to its negative impact on ejaculated semen parameters (reduced sperm concentration and poor sperm motility). Surgical treatment of varicocele improves sperm quality [13, 14].

Testicular temperature: The testicles are outside of the body due to them requiring an environment cooler than the normal body temperature to produce sperm effectively. The varicocele elevation in temperature harms sperm-triggering the cells and makes it less efficient, the same as environmental factors like prolonged exposure to heat or high temperature. That rise in temperature can reduce the quantity and quality of sperm. A study published in the Journal of Urology found that higher temperatures had a negative effect on sperm production [15].

**Table 1:** Parameters studied fertile individuals Normozoospermic individuals with varicocele

Sperm parameters	Normozoospermic	Individuals with varicocele
Sperm concentration (million/ml)	79.56±5.15	47±3.78*
Percentage of sperm with progressive motility (%)	79.17±1.53	41.69±2.84*
Percentage of normal sperm morphology (%)	62.78±1.77	45.36±1.79*
Ejaculation time (min)	14.11±0.58	18.16±0.56*
Semen volume (ml)	3.9± 0.28	3.82± 0.18



**Fig 1:** 8-HODG level in varicocele patients compared to normozoospermic group.

The result show a significant increase the level of 8-HODG in patients with varicocele compared to the Normozoospermic group. It shows a significant increase in the protein value, which is an indicator of DNA damage, and the reason may be due to oxidative stress: it leads to damage to the DNA in the sperm, which reduces their quality and ability to fertilize [8].

**Conclusion**

The present study was conducted to evaluate the effect of Varicocele on Semen parameters. It was found from the study that it had a negative effect on semen as the results revealed that the varicocele affects various aspects of semen. First, varicocele modifies genetic material inside sperm, which then may increase the risk for genetic

abnormalities or defects. Secondly, it also influences sperm count as the total sperm count per ejaculate decreases in the case of individuals with varicocele. Third, the shape of sperm is affected, so that some sperm become abnormal or are no longer able to fertilize the egg. Finally, varicocele influences the progressive motility of sperm, so the ability to swim and move toward the egg could be weak or ineffective. According to the findings of this study, varicocele is viewed as a detrimental element that interferes with reproductive ability because of its impact on the basic properties of sperm.

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