

# What Factors are Accountable for Sperm DNA Fragmentation?

Asiya Mansoori\*

Department of Biomedical Engineering, Lovely Professional University, India

## RESPONSIBLE FACTORS FOR SPERM DNA FRAGMENTATION

### Paternal age

According to studies, rising age is linked to increased sperm DNA fragmentation, which is most noticeable in men in their late 40s and early 50s. Men under the age of 30 had an average DNA fragmentation index of 35.6 percent, while men over 50 had an average DFI of 47.7 percent, a level that is likely to have an influence on fertility.

Those over the age of 50 were more than four times more likely than men under 30 to have sperm DNA fragmentation, according to a study of 2,681 male patients in Chile.

What causes this to happen? Several theories have been proposed. Cells become less capable of repairing their own DNA damage as they age, potentially leading to the production of sperm with more damage. Furthermore, as men age, they accumulate DNA damage in their testes (due to oxidative stress), which is thought to have an impact on the sperm cells produced. It's also possible that the greater damage is due to a decrease in the number of cells in the testicles that are essential for sperm production as people become older, or that the mitochondria that power sperm cells become less effective [1].

### Smoking

Cigarette smoking has been linked to increased oxidative stress and exposure to a variety of harmful substances (including cadmium and nicotine). Smokers have higher amounts of sperm DNA fragmentation, according to several studies, and the extent of DNA damage is connected to how long the patient has been a smoker and how many cigarettes they smoke.

Researchers discovered that smokers had a considerably larger percentage of sperm with aberrant DNA condensation than non-smokers in one study of infertile patients, and that the abnormalities were proportionate to both the number of cigarettes smoked per day and the length of smoking.

Researchers discovered that of four patient groups—control, alcohol-drinking, cigarette-smoking, and drinking/smoking—the two groups with smoking patients had the highest average levels of sperm DNA fragmentation [2]. Drinking proved to have a minor

impact on sperm DNA damage, but smoking appeared to have a significantly greater impact on sperm DNA fragmentation.

### Illness or infection

Illness or infection, such as influenza, cancer, or sexually transmitted illnesses, are linked to increased sperm DNA fragmentation, possibly because they increase oxidative stress. Patients with sexually transmitted infections such as chlamydia or mycoplasma (a bacterium that causes inflammation in the urinary system) had higher DFI than controls in a research (an average of 35 percent compared to 11%).

Sperm DNA fragmentation testing indicated that DFI increased dramatically in the month after a fever—by 24% in the 15 days following the fever and 36% in the 37 days following reflecting the infection and fever's impact on the sperm that were in production at the time of the sickness. The DFI did not return to normal levels until about 2–3 months after the fever had passed, indicating the length of spermatogenesis (which takes around 70–90 days to complete) [3].

And, while cancer therapy is well-known for affecting fertility (more on that below), new research suggests that cancer itself may harm sperm DNA. Before receiving any chemotherapy or radiation treatments, cancer patients had higher levels of sperm DNA breakage than even infertile males, according to a study that compared them to fertile and infertile patients.

### Cancer treatment

Chemotherapy and radiation are life-saving cancer treatments, but they can have an adverse effect on fertility.

Chemotherapy works by identifying fast-dividing cancer cells and killing or preventing them from dividing using drugs. However, because the medicine is delivered to the entire body via the bloodstream, it can also harm other cells, including sperm cells. The most commonly used chemotherapy drugs for testicular cancer have been linked to an increase in sperm DNA damage in male rats, according to research. After 8 weeks of chemotherapy treatment for leukaemia, a case study of a human cancer patient revealed a significant increase in sperm DNA damage, which lasted nearly a year later.

Radiation therapy entails aiming high-energy beams at cancer cells in the hopes of killing them. However, as a result of this treatment,

\*Correspondence to: Asiya Mansoori, Department of Biomedical Engineering, Lovely Professional University, India, E-mail: mansoori.asiya@gmail.com

Received: September 02, 2021; Accepted: September 17, 2021; Published: September 24, 2021

Citation: Mansoori A (2021) What Factors are Accountable for Sperm DNA Fragmentation? J Fertil In vitro IVF Worldw Reprod Med Genet Stem Cell Biol 9:5. doi: 10.35248/2375-4508.21.9.245

Copyright: © 2021 Mansoori A. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

areas of the body surrounding the tumour may be damaged, thereby reducing or terminating sperm cell production [4]. Some men who are exposed to radiation will experience a transient decrease in fertility that will return in the years after treatment; others who are exposed to higher levels of radiation may have their sperm production permanently halted. In lab research, it has been shown that radiation causes a dose-dependent increase in DNA damage in sperm.

According to Livestrong, up to 75% of reproductive-age males diagnosed with cancer may have infertility as a result of therapy. As a result, it is strongly advised that men diagnosed with cancer freeze their sperm before beginning therapy. To learn more about sperm freezing, go here.

### **Exposure to chemicals, toxins, or radiation**

According to the CDC, a variety of pollutants and heavy metals have been linked to DNA damage in sperm. Phthalates and styrene (chemicals used in plastic production); organophosphate, carbaryl, or fenvalerate (pesticides/insecticides); lead; or benzene (a chemical frequently used in manufacturing and also found in gasoline and tobacco smoke).

One research of healthcare professionals exposed to ionising radiation (used in X-rays) found that sperm DNA fragmentation levels were considerably greater among exposed men than among

non-exposed men [5]. A man's employment is usually the source of the most harmful long-term, repeated exposure. Healthcare professionals, for example, are exposed to radiation on a regular basis, as shown above. Manufacturing, agriculture, and the military are among the other occupations that provide a risk of exposure.

### **REFERENCES**

1. Evenson DP, Jost LK, Marshall D, Zinaman MJ, Clegg E, Purvis K, et al. Utility of the sperm chromatin structure assay as a diagnostic and prognostic tool in the human fertility clinic. *Hum Reprod.* 1999; 14: 1039-1049.
2. Speyer BE, Pizzey AR, Ranieri M, Joshi R, Delhanty JDA, Serhal P. Fall in implantation rates following ICSI with sperm with high DNA fragmentation. *Hum Reprod.* 2010; 25: 1609-1618.
3. Boe-Hansen GB, Fedder J, Ersbøll AK, Christensen P. The sperm chromatin structure assay as a diagnostic tool in the human fertility clinic. *Hum Reprod.* 2006; 21: 1576-1582.
4. García-Ferreya J. Sperm DNA Fragmentation and its Relation with Fertility. *New Discoveries in Embryology.* IntechOpen. 2015.
5. García-Ferreya J, Luna D, Villegas L, Romero R, Zavala P, Hilario R, et al. High aneuploidy rates observed in embryos derived from donated oocytes are related to male aging and high percentages of sperm DNA fragmentation. *Clin Med Insights Reprod Health.* 2015; 9: 21-27.