

Understanding Sperm DNA Fragmentation

GP Checklist & Clinical Framework

A standard semen analysis measures count, motility & morphology - but not DNA integrity. Up to 15% of infertile men have a completely normal Semen Analysis.³

When fragmented, damaged, oxidised or poorly packaged, the embryo may implant and then stall, manifesting as recurrent miscarriage, failed IVF cycles and/or poor embryo development, even when standard Semen Analysis appears entirely normal.

What is sperm DNA fragmentation (SDF)?

Definition, mechanism and implication

Sperm DNA fragmentation (SDF) refers to single and double-strand breaks in the sperm's DNA helix.

Three primary mechanisms:¹

- 1) Oxidative stress - ROS attack and cleave DNA strands. Driven by smoking, obesity, toxin exposure, poor diet and sedentary lifestyle.²
- 2) Abortive apoptosis - incomplete programmed cell death leaves fragmented cells in the ejaculate.
- 3) Defective chromatin packaging - failure to replace histones with protamines during spermiogenesis leaves DNA structurally vulnerable.

Implications:

- early pregnancy loss
- recurrent miscarriage
- increased risk of some cancer in offspring

Clinical Threshold Matrix ^{1 3}

DFI Level	Clinical Impact	GP Action / Recommendation
<15% Low	Good prognosis. Unlikely to impair conception or ART outcomes.	Reassure. Optimise lifestyle as primary prevention.
15-25% Moderate	May reduce natural pregnancy rates and early embryo quality.	Lifestyle modifications. Antioxidants. Retest 90 days. Consider referral to a Fertility Specialist.
25-40% High	Significantly impairs embryo development and live birth rates; raises miscarriage risk.	Address modifiable causes urgently. Refer to a Fertility Specialist for specialised advice.
>40% Severe	Profound impairment. Recurrent IVF failure and pregnancy loss even with ICSI.	Urgent referral to a Fertility Specialist.

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Modifiable Actions to Reduce Sperm DNA Fragmentation ²

Breathe	Eliminate toxin exposure	Smoking cessation is the highest-yield intervention. Smokers show up to 3x higher DFI. ² Avoid vaping, pesticides, solvents and occupational heat. Sperm cycle is 70-90 days.
Eat	Antioxidant-rich diet & supplementation	Omega-3s, vitamins C & E, zinc, selenium, lycopene and folate. Reduce processed foods, alcohol and trans fats. Oral antioxidant therapy reduces DFI in controlled studies. ²
Move	Achieve healthy BMI & exercise regularly	Obesity elevates scrotal temperature and ROS production, raising DFI. ² Target BMI <30; 150 min/week moderate aerobic exercise. Avoid anabolic steroids - risk of azoospermia.
Age	Counsel on advanced paternal age	DFI rises independently with age - 17/19 studies in a review of 40,668 men confirm this. ⁴ Men >40 with fertility concerns should have proactive SDF testing regardless of SA result.

How is sperm DNA fragmentation tested at Repromed?

HALOSPERM is a validated clinical assay which measures the DNA fragmentation index % (DFI %) of the semen sample. The assay assesses loop dispersion from the nuclear core of spermatozoa.

Under assay conditions when "normal" sperm denature correctly - a halo will be visible.

A "damaged" sperm will fail to produce or produce a weak halo indicating fragmentation.



Non
Fragmented DNA

Moderate DNA
Fragmentation

High DNA
Fragmentation

When to consider testing

Clinical indications

- Unexplained infertility with normal semen analysis
- Recurrent miscarriage (≥2 losses)
- Repeated failed IVF/ICSI cycles
- Significant oxidative risk factors (smoking, obesity, heat, toxins)
- Advanced paternal age - 17/19 studies confirm age independently elevates DNA fragmentation index, even with normal semen analysis⁴

¹ Wright C, et al. *Reprod Biomed Online*. 2014;28(6):684–703. PMID: 24745838 ² Wright C, et al. *ibid*. ³ Alvarez Sedo C, et al. *JBRA Assist Reprod*. 2017;21(4):314–323. ⁴ Gonzalez DC, et al. *World J Mens Health*. 2022;40(1):104–115. PMID: 33987998 ⁵ Levine H, et al. *Hum Reprod Update*. 2023;29(2):157–176.

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