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Redefining Male Infertility: ORP as a Key Marker for Sperm Quality

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INTRODUCTION

Oxidative stress plays a crucial role in male infertility by impairing sperm function and increasing DNA fragmentation. ORP is an emerging marker to evaluate oxidative stress levels in semen. Elevated ORP has been associated with poor semen quality, including reduced motility and concentration. However, its relationship with SDF remains unclear, and studies assessing its predictive value for male infertility are limited. Understanding the association between ORP, sperm concentration, and SDF may help refine diagnostic protocols and improve patient management.

STUDY QUESTION

Can ORP serve as a reliable biomarker for male infertility assessment, and should it be integrated into routine testing?

STUDY DESIGN, SIZE, DURATION

This retrospective cohort study analyzed semen samples from 900 men undergoing fertility evaluation over two years.

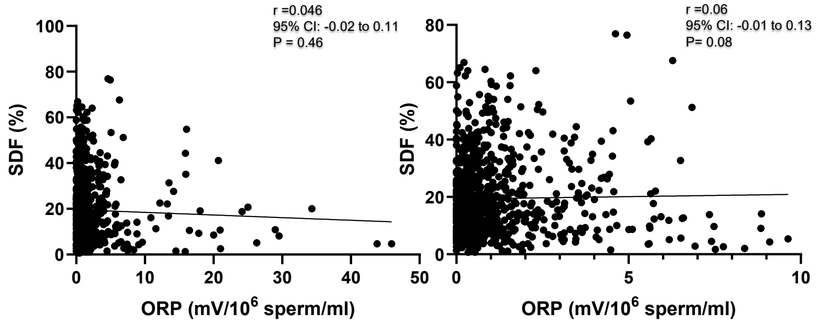
PARTICIPANTS/MATERIALS, SETTING, METHODS

This study included men (mean age: 38 years) undergoing fertility evaluation. Semen samples were collected and analyzed following WHO guidelines to ensure standardized assessment of oxidative stress and sperm quality. Sperm DNA fragmentation (SDF) was measured using the TUNEL assay on the BD FACSLyric flow cytometer, while oxidation-reduction potential (ORP) was assessed with the MiOXSYS analyzer. Semen parameters, including concentration, total sperm count, pH, and abstinence duration, were also recorded.

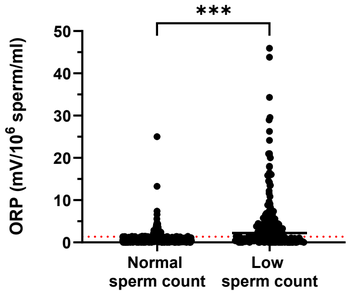
RESULTS

Semen analysis of 900 men undergoing fertility evaluation showed a mean sperm concentration of 57.2 × 10^6 sperm/mL and a total sperm count of 147.9 × 10^6 sperm/sample. The mean semen pH was 8.2, and the average abstinence period was 2.9 days. ORP levels averaged 1.7 mV/10^6 sperm/mL, with values >1.34 mV/10^6 sperm/mL indicating high oxidative stress. The mean SDF was 19.4%, categorized as low (≤16.9%), moderate (16.9–30%), or high (>30%). The distribution of ORP and SDF categories among patients was: low ORP & low SDF (38.4%), low ORP & moderate SDF (22.6%), low ORP & high SDF (11.8%), high ORP & low SDF (13.8%), high ORP & moderate SDF (7.3%), and high ORP & high SDF (6.1%). A weak, non-significant correlation was found between ORP and SDF (Spearman r = 0.046, 95% CI: -0.02 to 0.11, P = 0.46). However, a significant negative correlation was observed between ORP and sperm concentration (Spearman r = -0.569, 95% CI: -0.61 to -0.52, P < 0.001).

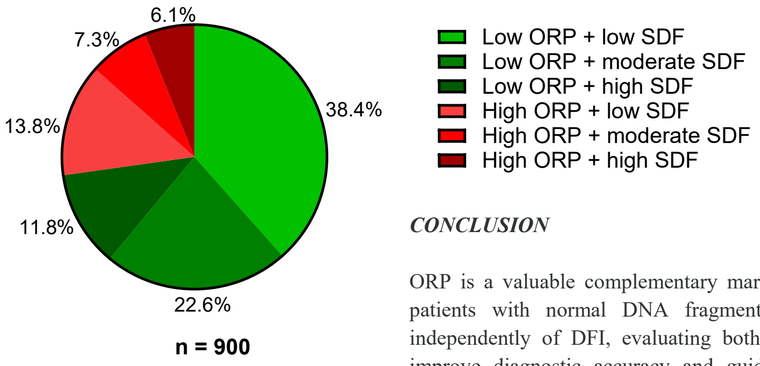
Correlation between ORP and SDF

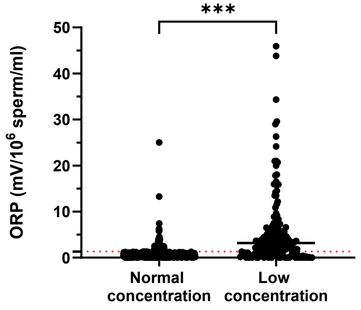


ORP distribution by sperm parameters



Distribution of patients by ORP and SDF levels





CONCLUSION

ORP is a valuable complementary marker for semen quality, helping identify infertile patients with normal DNA fragmentation. Since oxidative stress affects fertility independently of DFI, evaluating both markers in male infertility assessments could improve diagnostic accuracy and guide personalized treatment strategies, ultimately enhancing reproductive outcomes for affected individuals.

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No conflict of interest to dsclose