Homocysteine and malondialdehyde levels in seminal fluid and their influence on sperm quality

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Introduction: Homocysteine is a naturally occurring sulphur containing amino acid that is produced during the metabolism of methionine. Dietary methionine is converted to S-adenosyl methionine, which is then demethylated to S-adenosyl homocysteine (SAH). SAH is hydrolyzed to homocysteine and adenosine (Radwell VW, 2000). Homocysteine is involved in a complex and dynamic vascular injury and repair system (Vaccaro et al., 2000)

Deficiencies of the vitamins folic acid (B9), pyridoxine (B6), or B12 can lead to high homocysteine levels (Miller et al., 1994). However, supplementation with pyridoxine, folic acid, B12 or trimethylglycine reduces the concentration of homocysteine in the bloodstream (Coen et al., 2001). Although, there was a correlation between low folate in seminal plasma and increased sperm DNA damage in a study by Boxmeer at al., 2009. There are few studies in the literature which report interactions between sperm quality, together with its severity and seminal plasma homocysteine levels. Therefore, the purpose of this study is to determine the relationship between homocysteine and malondialdehyde concentration in seminal plasma of fertile and subfertile men, as biomarkers of oxidative stress on sperm quality count, motility, chromatin and membrane integrity and DNA fragmentation.

Material and Method: Semen sample of 48 male (fertile =19; subfertile =28) were included in this study. After semen liquefaction, semen samples were analysed according to WHO guideline (1999). Membrane integrity was assessed by (HOS-Test). Whereas, DNA integrity evaluated by Chromomycine CMA3 method and DNA fragmentation by TUNEL- Assay. Malondialdehyde (MDA) levels were measured by Thiobarbituric acid, TBA method and Homocysteine concentration was evaluated using high performance liquid chromatography (HPLC) technique.

Results: The mean values of spermatozoa concentration, motility and membrane integrity in all investigated samples were (58.20±54.40 mill/ml; 17.34 ± 23.98% and 76.51±15.02%). Homocysteine concentration was 20.2±4.9µmol/L, while Malondialdehyde level was 3.7±1.2µmol/L. However, semen concentration, motility, membrane integrity, DNA integrity and DNA fragmentation in subfertile group

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were \((78.3\pm50.1\text{mill/ml}; 24.3\pm14.2\%; 87.6\pm9.0\%; 58.3\pm14.8\% \text{ and } 8.4\pm21.0\% \text{ respectively})\) and the corresponding values of fertile group were \((116.5 \pm47.1\text{mill/ml}; 28.2\pm21.2\% 81.6\pm11.6\%; 67.9\pm10.2\% \text{ and } 8.7\pm25.1\%)\).

Spermatozoa concentration, membrane (HOS-test) and DNA integrity (CMA3) from fertile group was significantly higher than those of subfertile group \((p=0.001)\). Homocysteine and malondialdehyde levels in seminal plasma were similar in subfertile and fertile groups \((20.6\pm3.2 \text{ µmol/l}; 3.9\pm1.3\text{µmol/l} \text{ vs. } 19.6\pm6.6 \text{µmol/l} \text{ and } 3.4\pm0.9 \text{µmol/l})\).

Homocysteine levels correlate significantly negative with sperm concentration in both groups \((r=-0.387; p=0.024)\). Similar was found between MDA level and DNA integrity \((r=-0.390; p=0.4)\). However, Homocysteine levels correlate significantly with Malondialdehyde only in subfertile group \((r=0.606; p=0.017)\).

Conclusion: Homocysteine and Malondialdehyde concentration in seminal plasma affect sperm parameters not only of subfertile but also by fertile group and should be recommended as oxidative stress biomarkers by semen evolution of patients undergoing ART therapy.

Key Words: Homocysteine, Sperm quality