Obesity and Male Fertility: A Meta–Analysis on the Effects of BMI on Sperm DNA Fragmentation in Men

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Abstract

Objective: To assess the effects of overweight (25<BMI<30) and obesity (BMI≥30) on sperm DNA fragmentation in men

Design: A systematic search was conducted using MEDLINE/PubMed, SJU Discover and Google Scholar to identify all relevant studies published up to 2017 (March). Participants were men from fertility/unlological clinics and general population. The outcome measure was DNA fragmentation index (DFI).

Materials and Methods: The study groups were stratified and compared according to BMI categories as defined by the WHO. Overweight (OW), and Obese (OB) were included. Subgroup analysis included population type- infertile men versus fertile men; and test type for DFI- Sperm chromatin structure assay (SCSA) or Terminal deoxynucleotidyl transferase dUTP nick end labeling (TUNEL). Statistical analysis was done using RevMan 5.0 software and Comprehensive meta-analysis software. Pooled mean differences (MD) between comparison groups were calculated to determine the effect size. Both fixed effects models (FEM) and random effects models (REM) were fitted to assess the model-types that were most suited to the data. Heterogeneity was evaluated using the Q test and the I-squared statistic.

Results: A total of 7 studies were included in the meta-analysis, involving 3,250 subjects. Overweight men had higher DFI compared with men with normal BMI. Overweight men MD= 0.62 (95%CI [-2.20, 3.44], P = 0.67) and obese men MD= 0.64 (95%CI [-3.97, 5.07], P = 0.78), when compared with men with normal BMI.

The pooled effect estimates were not materially affected by the test method (SCSA and TUNEL were the only two methods evaluated) (Figure 2 & 3) or study population. Overall, DFI was increased in both overweight men and obese men (Figure 1) when compared with men with normal BMI.

Conclusion: Pooled results from evaluated studies suggest that BMI negatively affects sperm DNA fragmentation in men but not statistically significant. Therefore, the full clinical implications of the on the association between BMI and sperm DNA fragmentation deserves further investigation.

Introduction

Overweight and obesity are associated with significant reductions in levels of testosterone and the sex hormone binding globulin. However, the association between BMI, semen quality, and overall male fertility has proven to be controversial and contradictory, as various studies differ on whether or not there is a correlation between obesity and male fertility. While few studies suggest that the reduced semen quality and infertility are affected by other factors, rather than BMI.

Few studies have concluded that higher BMI values are related to increased DNA fragmentation in sperm. The percentage of defective chromatin was found to be higher in sperm of men with normal BMI than in men with overweight and obese BMI. Studies suggesting that high BMI negatively affects semen quality, attribute to oxidative stress that causes DNA damage. This oxidative stress to the spermatozoon can lead to both single and double-strand DNA fragmentation, reducing the vital functions of sperm and leading to impaired fertilization, altered embryo and blastocyst development. Elevated levels of sperm DNA damage can lead to increased time to natural conception, decreasing IVF/ICSI and IUI pregnancy rates, and an increased rate for miscarriages. Recently, some studies have established a link between increased male BMI and reduced live birth outcomes. Further concluding that men with high BMI had significantly lower success with fertilization and clinical pregnancy compared to men with normal BMI.

Studies have also examined the effects of weight loss on improvement in sperm quality. With the prevalence of obesity rising it becomes important to further examine the effects of male obesity on sperm viability and pregnancy outcomes.

The aim of this meta-analysis is to evaluate the current evidence on the effects of paternal obesity on semen quality parameters related to DNA damage - DNA fragmentation index.

Methodology

Search Strategy

Database search was conducted using MEDLINE/PubMed, SJU Discover and Google Scholar to identify all relevant studies published up to 2017 (March). Participants were men from fertility/unlological clinics and general population. The outcome measure was DNA fragmentation index (DFI).

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