Obesity and Male Fertility - A Meta–Analysis on the Effects of BMI on Semen Parameters in Infertile Men

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INTRODUCTION

Obesity has been linked as one of the risk factors for male infertility. There is controversial or debatable evidence indicating the role of obesity and body mass index (BMI) on male infertility. Recent studies have suggested an increased risk of abnormal semen parameters among overweight men. Obesity is associated to decline of semen parameters such as motility, concentration and morphology. These parameters are most frequently used in clinical settings to assess fertility. However, the evidence is not unequivocal and some studies have found no effect on sperm quality. Hence there is a need to assess recent literature on the effects of obesity on semen parameters and thereby improve our understanding of the underlying mechanisms, for the development of public health messages for the consideration of overweight men. In 2010, the WHO established new criteria for laboratory examination of human semen. Since then, many studies have evaluated the real impact of these changes in semen parameters such as motility, concentration and morphology. These parameters are most frequently used in clinical settings to assess fertility. However, the evidence is not unequivocal and some studies have found no effect on sperm quality. Hence there is a need to assess recent literature on the effects of obesity on semen parameters and thereby improve our understanding of the underlying mechanisms, for the development of public health messages for the consideration of overweight men.

METHODOLOGY

Search Strategy

Data bases of PubMed, SÚ Discover and Google Scholar were searched systematically to identify all relevant studies published from 2010 to 2017. The keywords search terms used were 'BMI' OR 'obesity' AND 'sperm' OR 'ferti*', 'pregnancy'. The initial search was done by one researcher to screen matching titles and then their abstracts. If the full texts of selected abstracts matched our inclusion criteria, then they were reviewed in entirety. To improve search outcomes, review articles and reference lists of selected articles were also reviewed. Studies were analyzed for inclusion independently by two of the authors, any discrepancies were resolved by discussion.

Selection of Studies and Validity Assessment

Articles were only included if they reported on infertile men, were not review articles or randomized controlled trials and used the BMI categories as defined by the WHO. The BMI categories used as defined by WHO are as follows: Normal: BMI: 18.50 - 24.99, Overweight: BMI: 25.00 - 29.99, and Obese: BMI: ≥30.00. Studies focusing on the effect of BMI on semen parameters focusing on the effect of BMI on semen quality of infertile men with other risk factors were also included. Participants were infertile males aged 13 years and older regardless of population size and origin. The outcome measures were semen volume (mL), sperm count (x10⁴/mL), motility (%), morphology (%), and total motile sperm count (x10⁴) but these parameters are some of the most frequent measures used for investigations of male infertility. In addition, we reviewed studies with outcome measures of clinical pregnancy rate (CPR) and live birth rate (LBR) achieved through ART. We calculated total progressive motile sperm count (TPMSC) from other parameters given in the studies.

RESULTS

A total of 12 studies were included in the meta-analysis, involving 20,491 subjects. Semen volume (Figure 1), motility (Figure 2), and total progressive motile sperm count (Figure 3) were significantly reduced in OW group when compared to men with normal BMI. Sperm concentration, morphology and CPR (Figure 4) and LBR (Figure 5) achieved through ART were also reduced in OW men.

• Obese men as compared to men with normal BMI showed a significant decline in semen volume (Figure 1), sperm count, motility (Figure 2), and total progressive motile sperm count (Figure 3).

• The recent changes in the 2010 WHO reference values for semen parameters had significant negative effects only on TPMS in OW men and semen volume, count, morphology and TPMS in OB men.

CONCLUSIONS

• Pooled results from evaluated studies suggest that BMI negatively affects semen parameters in infertile men. BMI also negatively effects CPR and LBR achieved through ART.

• The full clinical implications of the 2010 WHO criteria on the association between BMI and human semen quality and fecundity rates deserve further investigation.