Obesity and Male Fertility - A Meta-analysis on the Effects of BMI on Reproductive Hormones in Men

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Abstract

Objective: To assess the effects of overweight (25 < BMI < 30) and obesity (BMI ≥ 30) on reproductive hormones in men. Design: A systematic search was conducted using MEDLINE/PubMed, SJJ Discover and Google Scholar to identify all relevant studies published up to 2017 (April). Participants were men from fertility/andrological and general population hospitals. Studies evaluating Serum LH, FSH, Total testosterone, Serum LH, Sex hormone-binding globulin (SHBG), and Serum Estradiol. Materials and Methods: Participants were males aged 13 years and older regardless of population size and origin. Each reproductive hormone was evaluated separately and independently. The study groups were stratified and compared according to BMI categories based on WHO classification - Normal, Overweight (OW), and Obese (OB). Statistical analysis was done using RStudio 0.98.4 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 and the I-squared statistic. Results: A total of 8 studies were included in the meta-analysis, involving 3,757 subjects. Serum FSH did not show a significant decline in OW men but not in OB men when compared to men with normal BMI. Overall, the pooled estimate indicated that total testosterone was significantly lower in both OW and OB men (MD -4.19 nmol/L, 95%CI [-7.03, -1.36], P<0.001) and total testosterone was significantly lower in both OW and OB men (MD -4.19 nmol/L, 95%CI [-7.03, -1.36], P<0.001) and OB men (MD -13.90 nmol/L, 95%CI [-17.70, -10.11], P<0.001), when compared to men with normal BMI. There was no effect observed on serum estradiol for both OW men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04) and OB men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04) and OB men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04) and OB men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04) and OB men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04) and OB men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04) and OB men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04) and OB men (MD 0.00 nmol/L, 95%CI [-0.00, 0.01], P=0.04). Studies focusing on the effect of BMI on sperm quality of infertile men with other risk factors were also excluded. Participants were infertile males aged 13 years and older regardless of population size and origin. The outcome measures were Follicle stimulating hormone (FSH), Total Testosterone, Luteinizing hormone (LH), Serum Estradiol, Serum hormone binding globulin (SHBG). Results had to be expressed as mean ± SD. The following characteristics were assessed for each study: (a) study population – infertile or fertile men.

We adhered to the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) statement to report results. Validity of each study was determined by using the criteria for non-randomized studies to assess the risk of bias [Sterne JAC, R.J., Reeves BC on behalf of the development group for ACROBAT- NRSI, A Cochrane Risk Of Bias Assessment Tool: for Non-Randomized Studies of Interventions (ACROBAT- NRSI)].

Data Abstraction

We evaluated each reproductive hormone separately. First, we analyzed the studies for BMI and reproductive hormones comparing Overweight to Normal BMI and Obese to Normal BMI combined. We also conducted a subgroup analysis based on the study population- fertile men, infertile+ fertile men or infertile men. Analysis

Statistical analysis was undertaken using RevMan 5.0 software (Cochrane Collaboration, Oxford, UK). Statistical analysis was performed using the Q test and the I-squared statistic. Statistical significance was set at a p value <0.05. We used the REM when heterogeneity was high (I² > 50%). Subgroup analyses, as previously described, were carried out to identify potential sources of the heterogeneity. Conclusions

• A total of 8 studies were included in the meta-analysis, involving 3,757 subjects.
• Serum FSH did not show a significant decline in OW men (Figure 1) and OB men (Figure 2).
• Serum LH, Total testosterone showed a significant decline in OW men but not in OB men when compared to men with normal BMI.
• Overall, the pooled estimates indicated that total testosterone was significantly lower in both, and the magnitude of the effect size was higher in OB than OW men.
• Similar results were obtained for SHBG. SHBG significantly declined in both OW (Figure 1) and OB men (Figure 2), when compared to men with normal BMI.
• There was no effect observed on serum estradiol for both OW men and OB men, when compared to men with normal BMI.

Figures

Figure 1. Effect of BMI on reproductive hormones in overweight men compared with men with normal BMI.

Figure 2. Effect of BMI on reproductive hormones in obese men compared with men with normal BMI.