

Obese women have less ω -3 polyunsaturated fatty acids in their oocytes

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Study question:

Is the fatty acid oocyte composition related with maternal weight?

Summary answer: Obese women and also overweight women showed a different fatty acid profile when compared with normal weight women.

What is known already: There is an epidemic of obesity. Obesity complications are well known in medicine, gynecology and reproductive medicine. The siblings of obese women have higher weights when newborn infants and have an increased rate of infant obesity. Polyunsaturated fatty acids (PUFAs) are of paramount importance in a healthy diet. Current western diets have an excess of ω -6 PUFA and a relative lack of ω -3 PUFA. This disbalance has been associated with obesity. We have previously shown that a number of fatty acids can be detected in human oocytes (Matorras et al, 1998), and that their ω -6/ ω -3 ratio was inside the ranges of the recommended dietary allowances.

Study design, size, duration:

During a 18 month period, **922** oocytes (**381** germinal vesicle, **208** metaphase I, **333** unfertilized metaphase II), corresponding to 302 women performing IVF/ICSI in two different centers were recruited. Three groups were established: normal weight (BMI 20-25), overweight (BMI 25-30), and obesity (BMI > 30).

Participants/materials, setting, methods:

The retrieved oocytes were grouped according to woman's BMI and maturation status (germinal vesicle, metaphase I or II). After thoroughly washing, their acyl composition was subjected to analysis by capillary gas chromatography in groups of 15-20 oocytes (since a lower number precluded the fatty acid analysis). Results were expressed as mole percentages of total amount.

Statistical analysis was performed by means of non-parametric analysis (Willcoxon, Mann Withney).

Main results

The fatty acid profile was not homogeneous along the three BMI groups considered. Total ω -3 PUFA content were highest in normal weight (1.82 %), decreasing as the BMI increased (1.64% and 1.44% for the overweight and obese groups, respectively). Interestingly, docosahexaenoic (DHA) and eicosapentaenoic (EPA) acids, the main ω -3 PUFA, showed a clear dependence on the BMI: EPA increased in the order obese<overweight<normal weight, contrary to DHA (normal weight<overweight<obese). ON the other hand ω -PUFA were significantly increased in obese women (11.59%) vs normal weight (12.31) and overweight (12.54).

A number of quotients were significantly different among the three aforementioned populations : the arachidonic acid /DHA was higher in normal weight and lower in overweight whereas the opposite occurred with arachidonic/linoleic acid and the DHA/ α linolenic acid were higher in lower in normal weight and higher in obese.

These distributions remained similar when the oocyte maturation state was taken into account. Moreover, MII oocytes showed the highest EPA content and the lowest DHA percentage.

Limitations:

Our MII population was restricted to unfertilized MII oocytes, thus the results may not be extrapolated to MII oocytes which do fertilize.

Wider implications of the findings:

1. The well-known poor outcome in obese women may be also related to an unfavourable fatty acid pattern.
2. It could be speculated that an unfavorable oocyte fatty acid pattern could be an early determinant of obesity in the infant and the adult.

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