Maternal and Paternal Body Mass Index and Offspring Obesity: A Systematic Review

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Introduction- what is known?

- High prevalence of overweight and obesity
- The intrauterine environment as an important factor that influences the body mass index (BMI) and adiposity in later life
- ‘Fetal overnutrition hypothesis’

Objective

To test the following hypothesis:

'**Paternal obesity**/adiposity **contributes equally to the obesity**/adiposity **of the offspring as compared to maternal obesity**/adiposity assessed before pregnancy'

Methods

- A **systematic review** of observational studies

- Sources of data:

  Electronic databases:

  - Medline
  - Embase
  - Cochrane Library

  Trial registries:

  - the ClinicalTrials.gov and the EU Clinical Trials Register website

- The time frame of the search - March 2012

Methods – inclusion criteria (1)

Type of participants

- Parents-offspring trios
- Offspring participants > 5 years of age

Methods – inclusion criteria (2)

Type of exposure

- Maternal BMI/adiposity measured before pregnancy or within the first trimester *vs* paternal BMI/adiposity analyzed in relation to offspring obesity/adiposity

- Paternal measurements obtained not later than up until childbirth
- Different ways of reporting participants weight and height

Methods – inclusion criteria (3)

The primary outcome measure:

- The association of offspring BMI/adiposity with pre-pregnancy BMI/adiposity of the mother, as well as BMI/adiposity of the father, and their relative contribution to explaining offspring BMI

Methods

The secondary outcome measure:

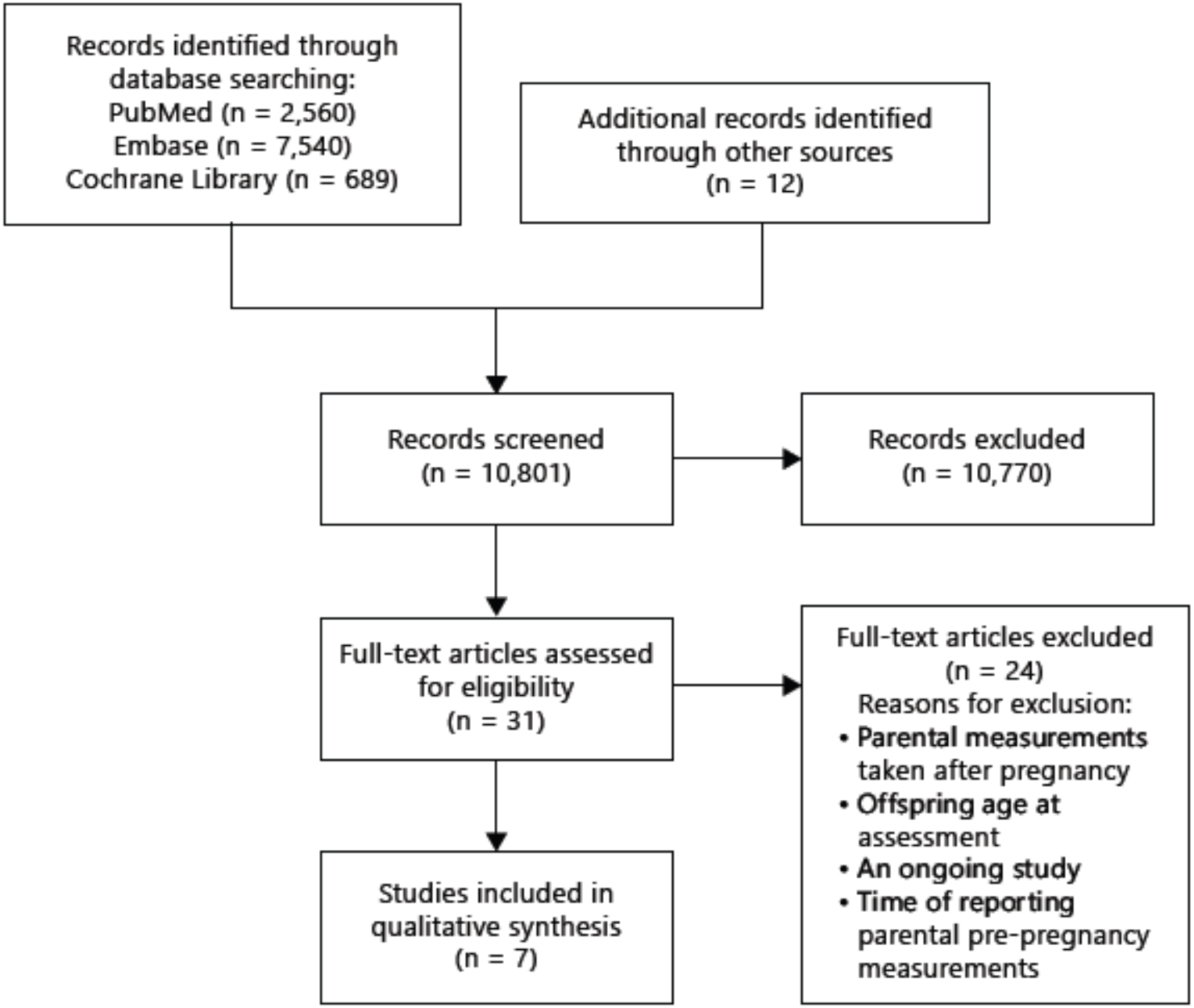
- Association of infant birth weight with pre-pregnancy BMI/adiposity of the mother, as well as BMI/adiposity of the father, and their relative contribution to explaining offspring birth weight

- Association of infant adiposity with pre-pregnancy BMI of the mother and the father and their relative contribution to explaining offspring birth weight

Methods – exclusion criteria

- Special populations
- Prenatal parental measurements reported at the time of offspring assessment
- Parental measurements obtained at the same time as offspring measurements
- Primary outcome not assessed

Results



Flow diagram of the study selection process

Results – included studies (1)

3 large birth cohorts:

- **The Avon Longitudinal Study of Parents and Children** (ALSPAC):
  - Lawlor et al., 2008
  - Smith et al., 2007
  - Reilly et al., 2005
- **The Mater-University Study of Pregnancy** (MUSP):
  - Lawlor et al., 2007
  - O'Callaghan et al.,1997
- **Northern Finland Birth Cohort:**
  - Jääskeläinen et al., 2011

- US parent-offspring trios:
  - Catalano et al., 2009

Results – included studies (2)

- **Design**: prospective cohort studies
- **Population**: general population from developed countries with the exception of the study by Catalano et al.
- **Offspring age at assessment**:
  - ALSPAC: 7, 7.5 and 9-11 years
  - MUSP: 5-6 and 14 years
  - Finnish Cohort: 16 years
  - US parents-offspring trios: 6-11 years

Results – quality assessment (1)

- Study design
- Descriptive data
- Measurements (units, methods)
- Definitions of obesity and overweight
- Statistics
- Conflict of interest
- Completeness of follow up
- Controlling for confounding factors (CF), effect modifiers
- Presentation of the results

Results – quality assessment (2)

Sources of the potential risk of bias:

- Indirect method of parental measurements
- The role of CF
- The issue of nonpaternity and not living with both biological parents

Results – primary outcomes

Direct comparison of parent-offspring associations

- Statistically stronger maternal influence found only in the MUSP cohort
  - The increase (in the fully adjusted model) in standardized offspring BMI for a 1 SD increase in maternal BMI *vs* paternal BMI:

0.362 SD (95% CI 0.323–0.402) *vs*

0.239 SD (95% CI 0.197–0.282)

p <0.0001

- Equivocal results obtained from two studies describing the ALSPAC cohort

Results – primary outcomes

Indirect comparison of parent-offspring associations

The effect estimated based on the presented odds ratios:

- The parental effect similar in the Finnish cohort
- Some trend toward a stronger maternal effect in other studies with ALSPAC and MUSP data

Maternal BMI as a stronger predictor of childhood obesity in 1 additional small study

Results – secondary outcomes

- Only 1 study (MUSP) provided data on the associations of parental BMI with offspring birth size.
- The maternal effect found to be stronger than the paternal effect ($p < 0.0001$) for all birth size outcomes.

Limitations

- Methods of parental measurements
- The risk of recall bias (mother’s prepregnancy weight)
- Dealing with CF and effect modifiers
- The assumption that both mother and father contribute to the shared lifestyle between parents and offspring to a comparable extent
- Unknown rate of overweight/obesity among parents
- BMI as an estimate of childhood fat mass

Conclusions

- **Our findings provide limited evidence to support the tested hypothesis.**

- The review identifies a gap for further evidence of better quality rather than contradicting a role for the fetal overnutrition hypothesis in the current obesity epidemic.

Thank you!