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Review

Prenatal markers of neonatal fat mass: A systematic review

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SUMMARY

Background: Environmental influences during pregnancy are able to affect off spring phenotype with lifelong effects. Clinical applicable markers are needed to identify foetuses at risk for neonatal adiposity. This systematic review aims to 1) review the current literature on prenatal markers of neonatal fat mass, and 2) appraise the clinical applicability of the assessed markers.

Methods: A systematic literature search was conducted to identify studies meeting the following inclusion criteria: 1) original research papers in English; 2) research on dynamic and measurable prenatal markers of neonatal fat mass; 3) neonatal fat mass measurement within one month after birth, using the four-compartment model, magnetic resonance imaging, dual-energy X-ray absorptiometry or air displacement plethysmography. Two reviewers independently performed study selection, assessment of methodological (QUADAS-II) and statistical quality and appraisal of clinical applicability.

Results: Of 2333 studies primarily identified by the search strategy, 16 studies were included. Four of these were both methodologically and statistically of moderate or high quality. Prenatal markers investigated were ultrasound parameters, maternal biochemical markers and maternal characteristics. Markers of predefined interest were maternal pre-pregnancy body mass index, fasting glucose and HbA1c, showing varying results. A meta-analysis was not possible due to substantial methodological heterogeneity. Clinically applicability of all markers was rated poor.

Conclusions: Although associations were found, no useful marker was identified, due to lack of methodological and statistical quality, inconsistent results and poor clinical applicability. No markers were investigated in the periconceptional and embryonic period.

Contents

Abbreviations: BMI, body mass index; GWG, gestational weight gain; F(F)M, fat (free) mass; %BF, percentage body fat; AT, adipose tissue; US, ultrasound; MRI, magnetic resonance imaging; ADP, air displacement plethysmography; DXA, dual-energy X-ray absorptiometry; TG, triglycerides; HDL-c, high density lipoprotein cholesterol; BGL, blood glucose levels; EFW, expected foetal weight; AC, abdominal circumference; FL, femur length; HC, head circumference; BPD, biparietal diameter; TVol, fractional thigh volume; AVol, fractional arm volume; FAST, foetal abdominal subcutaneous tissue; TF, thigh fat; IGF(BP-3), insulin-like growth factor (binding protein-3); (G)DM, gestational diabetes mellitus; 3D, 3-dimensional.

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1. Introduction

The worldwide increasing prevalence of obesity and features of metabolic syndrome in children leads to increasing morbidity and mortality at young age [1]. Obesity is a multifactorial condition, caused by environmental, biological and genetic factors, initiated in early life. The hypothesis of 'developmental origins of health and disease' (DOHAD) states that environmental influences during pregnancy are able to affect off spring phenotype with lifelong effects [2–4]. Epigenetic changes are thought to be pivotal in this long-term programming of foetal endocrine and cardio-metabolic function and consequently fat and lean mass development [5–7]. Both foetal over- and undernutrition have been related to obesity, and consequently increased susceptibility for non-communicable diseases later in life [3]. Birth weight is often used as a proxy of foetal growth. However, birth weight alone poorly predicts long-term risks, as it does not fully reflect the effects of foetal growth and programming of fat mass [8]. Therefore, neonatal body composition, rather than birth weight, may be a more accurate predictor of risk for non-communicable diseases later in life [9]. If we should be able to predict neonatal fat mass in the prenatal period, infants at risk for adiposity could be identified earlier. This would allow for early interventions to optimize foetal and neonatal growth and metabolic development. Prevention of unfavourable programming might help reduce non-communicable diseases in children, adults and their offspring [10].

The aims of this study are to: 1) provide a systematic review of the literature on prenatal markers or predictors of neonatal fat mass and 2) appraise the clinical applicability of the assessed markers.

2. Material & methods

2.1. Literature search and study selection

A systematic search was conducted using computerized bibliography databases until February 2015 to identify original articles on prenatal markers for neonatal fat mass. Medline, Google Scholar, Web of Science, Pubmed Publisher, Cochrane and Embase were comprehensively searched using keywords as described in the appendix. Two authors (JR and MV) independently screened the titles and abstracts of all citations retrieved and excluded those clearly outside the scope of the study. Papers potentially eligible for inclusion were read in full text, and included after consensus. Reference lists of all included papers were screened for potentially relevant publications not identified by our search.

Studies were included for analysis if they met the following criteria, defined prior to the search:

1) Assessment of potential prenatal markers of neonatal fat mass in neonates.
2) Full report articles, written in English, with no limitation on publication date.
3) Use of measurable and dynamic prenatal parameters as markers, e.g. body mass index (BMI), laboratory diagnostics or ultrasound parameters.
4) Fat mass as primary outcome measure, measured within one month after birth.
5) Use of accurate methods to measure body composition, comprising the four-compartment model, air displacement plethysmography (ADP), magnetic resonance imaging (MRI) and

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