Determination of fetal fat distribution in pregnancy and its correlation with maternal subcutaneous fat and body mass index.

Daly A[1,5], Pineda M[1,2], Quinton A[3], Liu A[2], Peek M J[1,4], Nanan R[2]

[1]Dept of Obstetrics and Gynaecology, Centenary Hospital for Women and Children, The Canberra Hospital, [2]The University of Sydney Nepean Clinical School, Faculty of Medicine and Health, [3]Medical Sonography, School of Health, Medical and Applied Sciences, CQ University Sydney Australia, [4]The Australian National University Medical School, [5]Dept of Obstetrics and Gynaecology, Queanbeyan Hospital.

Abstract

Early life events are known to lead to later adult metabolic sequelae. One example is neonatal obesity which is linked to both childhood and subsequent adult obesity and its related disease states.[1] Deviations from normal fetal growth are associated with abnormal neonatal fat distribution and predispose to lifetime obesity. Factors affecting fetal growth include maternal obesity.[1] It has been postulated that fat distribution in maternal obesity is more important than obesity itself.[2,3] Recent evidence suggests specifically visceral obesity, defined as excess adipose tissue found in the thoraco-abdominal area, negatively affects fetal fat composition and fetal obstetric outcomes.[1,2,3] However there is a dearth of research investigating maternal visceral adiposity and fetal fat composition and growth throughout pregnancy.

Objectives

The aim of this study was to investigate the association between maternal visceral obesity and fetal central and peripheral fat distribution in different trimesters for different birth weight quartiles.

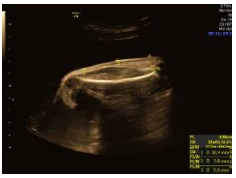
Methods

This is a retrospective analysis of clinical and ultrasound volume of imaging data of 1363 women collected in a tertiary perinatal ultrasound centre between 2012-2013. Data was collected from images stored on Viewpoint fetal databases at the Nepean Centre for Perinatal Care, Nepean Hospital and Penrith Ultrasound for Women. Those included in the study had a singleton pregnancy with low risk first trimester screening, normal morphology scan and no IDDM. Maternal SFT has been previously described and data from previous research[2] was used to correlate with fetal fat measures in the second and third trimester. The fetal visceral fat was measured by subtracting the layer of fetal fat from the axial view of the abdominal circumference (Figure 1A). The fetal subcutaneous thigh fat was measured from the average of the two distal ends and the mid-shaft of the fetal femur length on a longitudinal view (Figure 1B). All statistical analysis was undertaken using SPSS version 21 and Pearson's and Spearman's correlation were utilized. Neonates were divided into birth weight quartiles for statistical analysis.

Figure 1: Fetal visceral and thigh fat measurements

A. Abdominal circumference

B. Femur length



Results

Outcome data were available for 845 and 674 women in the second and third trimesters respectively. There is a significant weak correlation between maternal subcutaneous fat thickness (SFT) and peripheral fat accumulation in the lowest quartile Q1 (p=0.04) and central fetal fat adiposity in Q2 babies (p=0.01). [Table 1] Multivariate analysis showed that maternal SFT is a positive predictor of fetal central fat for Q4 babies in the 2nd trimester (p=0.04).

Table 1: Spearman's rho correlation between maternal subcutaneous fat and fetal adiposity

Fetal fat variables		Q1	Q2	Q3	Q4
FL 2nd	R	**-0.14**	0.07	0.04	0.12*
	P value	**0.04**	0.36	0.57	0.08
AC 2nd	R	-0.03	**0.18**	0.02	0.05
	P value	0.66	**0.01**	0.82	0.45
FL 3rd	R	0.03	0.05	0.04	0.04*
	P value	0.13	0.55	0.62	0.60
AC 3rd	R	0.05*	0.05*	0.02*	0.01*
	P value	0.51	0.49	0.80	0.96

*Pearson's correlation

Conclusion

- Second trimester distribution of fetal fat is significantly correlated with maternal adiposity in the lowest quartile babies and Q2 although correlation is weak.
- Prediction of fetal central adiposity in the second trimester is better predicted with maternal central adiposity than BMI in the highest quartile (Q4).

References

1. *Lopes et al. Correlation between pre-pregnancy body mass index and maternal visceral adiposity with fetal biometry during the second trimester. Int'l J of Gyne & Obs. 2017, Vol.138(2), 133-137.*
2. *Kenedy et al Maternal abdominal subcutaneous fat thickness as a predictor for adverse pregnancy outcome: a large cohort study. BJOG, 2016. Vol.123(2), 225-232.*
3. *Suresh et al. Comparison of maternal subcutaneous fat thickness and body mass index as markers for pregnancy outcomes: a stratified cohort study. ANZJOG, 2012. Vol.52(5), 420-426.*