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Comparison of growth and body composition of infants born to mothers with, and those without, gestational diabetes mellitus

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Abstract

In low-middle-income countries like South Africa, the application of selective screening for gestational diabetes mellitus (GDM) is based on the presence of risk factors. Gestational diabetes mellitus is public health problem which results in short- and long-term consequences, like obesity, type 2 diabetes mellitus (T2DM) and cardiovascular disease for both the mother and child later in life.

Children exposed to GDM *in utero* are likely to be born macrosomic resulting from increased body fat composition. Early life exposures alter body composition by increasing adipose tissue while increasing the risk of non-communicable diseases (NCD). Furthermore, metabolic factors may influence rapid growth in infancy by increasing adipose tissue which increases the risk of NCD later in life.

Aim: This study aimed to assess the uptake of universal screening for GDM and to investigate the relationship between maternal factors and birth outcomes (growth and body composition) in infants born to mothers with and those without GDM.

Design: The study comprised of two sections: (i) the uptake of universal screening and effectiveness of selective screening for GDM (ii) a case-control longitudinal comparative study that followed infants born to mothers with (n = 22) and without (n = 110) GDM from birth until six months of age.

Data collection and analysis: Pregnant women who had been referred from district hospitals and local clinics in Soweto and surrounding areas (Orange Farm and Lenasia) to Chris Hani Baragwanath Academic Hospital (CHBAH) were invited to participate in the study. The following inclusion criteria were applied: women who were less than 20 weeks pregnant at recruitment, black South African (ethnicity verbally reported), 18 years of age or older and pregnant with singleton pregnancies that were naturally conceived. Furthermore, no foetal abnormalities could have been detected and the women could not have been diagnosed with pre-existing diabetes or epilepsy. These women were booked to have an oral glucose tolerance test (OGTT) performed between 24-28 weeks gestation. Body composition data on the infants were obtained from air-displacement

plethysmography. Other collected data included socio-economic status (SES), obstetric history and anthropometric measurements of infants and mothers. Z-scores (weight, length, head circumference, body mass index (BMI)) and conditionals (weight and length) were treated as outcome variables. Data analysis included descriptive, bivariates and multivariate analyses which were performed in STATA 14. The probability value of < 0.05 was considered statistically significant.

Results: The majority of the pregnant women were screened for GDM but 43% of them failed to take up the offer of an OGTT for various reasons, including lack interest in testing, difficulty in getting time off at work, relocating to another province, previously tested at CHBAH and kept rescheduling but failed to attend; these women were therefore excluded.

At birth, the mean ± standard deviation weight of infants born to mothers with GDM was 3396g ± 502 while the mean weight for infants born to mothers without GDM was 3472 g ± 610 ($p = 0.587$). At six months, the mean weight was 7401 g ± 853 of infants born to mothers with GDM compared to 7389 g ± 1240 of infants born to mothers without GDM ($p = 0.948$). Despite there being no statistically significant difference in length ($p = 0.721$) at birth, the length of infants exposed to GDM was 49.64 cm ± 3.17 slightly longer than unexposed to GDM was 49.37 cm ± 3.32. At six months of growth, the mean lengths were 64.04 cm ± 1.88 versus 64.49 cm ± 2.98 in infants exposed and unexposed to GDM respectively ($p = 0.511$). There was no statistical difference at birth in the median head circumference of infants born to women with, 35.48 cm (34.63-36.40) and without, 35.15 cm (34.90-35.60) GDM ($p = 0.351$). Despite the statistical non-significance at six months, the head circumference of infants born to women with GDM were slightly bigger than infants born to women without GDM ($p = 0.963$).

According to the BMI-for-age, infants in both groups were not overweight or obese in the first six months of life. The weight gain of infants exposed to GDM was significant at one ($p = 0.005$), three ($p < 0.001$), four ($p = 0.026$) and six months ($p < 0.001$) of age compared to the infants unexposed to GDM. In addition the conditional length growth of the infants born to mothers with GDM showed significant growth at birth ($p = 0.004$), two ($p = 0.001$) and five months ($p = 0.049$) compared to infants born to mothers without GDM in the first six months of life.

Gestational age was the main predictor of majority of the birth outcomes, including birth weight (β = 159.82, 75.36; 244.27, p < 0.001), length (β = 1.08, 0.62; 1.55, p < 0.001) and head circumference (β = 0.20, 0.00; 0.40, p = 0.048). The greatest effect on infants' weight (β = 358.57, 48.41; 668.53, p = 0.024), length (β = 371.51, 65.09; 677.93, p = 0.018), head circumference (β = 0.75, 0.01; 1.49, p = 0.047), conditional weight (β = -0.27, -0.50; -0.03, p = 0.027) and conditional length (β = -0.29, 0.06; 0.51, p = 0.012) was maternal obesity. Maternal tertiary educational level was a determinant of fat mass index (β = 3.20, 0.68; 5.72, p = 0.013) and fat free mass index (β = 4.45, 0.36; 8.55, p = 0.033). In addition secondary schooling was significantly associated with infants' weight (β = 617.60, 99.24; 1135.97, p = 0.020), length (β = 633.94, 119.07; 1148.82, p = 0.016) and fat mass index (β = 2.40, 0.02; 4.77, p = 0.048). Furthermore, neonatal sex was a negative predictor of conditional weight index (β = -0.27, -0.43; -0.12, p = 0.001) and conditional length index (β = -0.46, -0.61;-0.32, p < 0.001). Infant growth (conditional weight and length) during the first month of life was significantly associated with maternal GDM status.

Conclusion: It is of concern that 43% of mothers declined to be tested for GDM, even though the service was offered at no cost. In the first six months of life there were no significant differences in the growth and body composition of infants born to women with and without GDM. Maternal obesity, gestational age and maternal education were major determinants of the infant anthropometry and body fat. The findings of this study add to the understanding of growth and body composition of infants born to women with and without GDM in South African.