



Ethnic differences in fetal size and growth in a multi-ethnic population



Line Sletner^{a,*}, Svein Rasmussen^b, Anne Karen Jenum^c, Britt Nakstad^{a,d},
Odd Harald Rognerud Jensen^e, Siri Vangen^f

^a Department of Pediatric and Adolescents Medicine, Akershus University Hospital, P.O. Box 1000, 1478 Lørenskog, Norway

^b Department of Clinical Science, University of Bergen, Bergen, Norway

^c Department of General Practice, Institute of Health and Society, University of Oslo, Oslo, Norway

^d Institute of Clinical Medicine, Campus Ahus, University of Lørenskog, Norway

^e Faculty of Health, Oslo and Akershus University College of Applied Sciences, Oslo, Norway

^f Norwegian National Advisory Unit on Women's Health, Department for Woman and Child Health, Oslo University Hospital, Oslo, Norway

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ABSTRACT

Objectives: Impaired or excessive fetal growth is associated with adverse short- and long-term health outcomes that differ between ethnic groups. We explored ethnic differences in fetal size and growth from mid pregnancy until birth.

Methods: Data are from the multi-ethnic STORK-Groruddalen study, a population-based, prospective cohort of 823 pregnant women and their offspring in Oslo, Norway. Measures were z-scores of estimated fetal weight (EFW), head circumference (HC), abdominal circumference (AC) and femur length (FL), in gestational week 24, 32 and 37, measured by ultrasound, and similar measures at birth. Differences in fetal size and growth were assessed using separate Linear Mixed Models including all four time points, with ethnic Europeans as reference.

Results: In week 24 South Asian fetuses had smaller AC, but larger FL than Europeans, and slightly lower EFW (-0.17 SD ($-0.33, -0.01$), $p = 0.04$). Middle East/North African fetuses also had larger FL, but similar AC, and hence slightly higher EFW (0.18 ($0.003, 0.36$), $p = 0.05$). Both groups had slower growth of AC, FL and EFW from this time until birth, and had -0.61 SD ($-0.73, -0.49$) and -0.28 SD ($-0.41, -0.15$) lower birth weight respectively. Ethnic East Asians, on the other hand, were smaller throughout pregnancy and had -0.58 SD ($-0.82, -0.34$) lower birth weight. Significant ethnic differences remained after adjusting for maternal factors.

Conclusion: We observed ethnic differences in fetal size and body proportions already in gestational week 24, and in fetal growth from this time until birth, which were only partly explained by key maternal factors.

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1. Introduction

Intrauterine growth restriction and low birth weight are main determinants of perinatal mortality and morbidity [1,2]. Moreover, early life growth may influence health and disease risk across the lifespan. Several studies have found a strong inverse association between birth weight and later risk of type 2 diabetes and cardiovascular disease, even when

birth weights are within the normal range [3]. The incidence of perinatal mortality, morbidity [4], and adult cardiometabolic disease is also linked to ethnicity and is markedly higher in several ethnic minority groups, compared with Europeans [5,6].

Most minority groups of Asian, Middle East and African ethnic origin, living in Europe, have lower mean birth weight than ethnic Europeans [7]. Neonates with South Asian ethnic origin have the lowest birth weights, and are “thin”, with smaller abdomen and less fat-free mass at birth [8–10]. In studies of ethnic South Asians fetuses, reduced abdominal circumference has been observed already from the beginning of the second trimester, compared with Europeans [11–13].

The primary aim of this study was to explore ethnic differences in fetal size and growth, either as estimated fetal weight (EFW) or as single dimensions (head circumference (HC), abdominal circumference (AC) and femur length (FL)), through three time points in pregnancy and similar measures at birth. Our secondary aim was to assess whether

Abbreviations: EFW, Estimated fetal weight; HC, Head circumference; AC, Abdominal circumference; FL, Femur length; LMP, Last menstrual period; WHO, World Health Organization; CH-length, Crown-heel-length.

* Corresponding author at: Department of Pediatric and Adolescents Medicine, Akershus University Hospital, 1478 Lørenskog, Norway. Tel.: +47 901 18 392 (Mobile).

E-mail addresses: line.sletner@medisin.uio.no (L. Sletner), Svein.Rasmussen@uib.no (S. Rasmussen), a.k.jenum@medisin.uio.no (A.K. Jenum), britt.nakstad@medisin.uio.no (B. Nakstad), oddrhj@gmail.com (O.H.R. Jensen), sirvan@ous-hf.no (S. Vangen).

differences were influenced by maternal factors available in routine clinical practice.

2. Methods

2.1. Population and design

Data are from a population-based cohort study of 823 pregnant women attending the Child Health Clinics in three municipalities in Groruddalen, Oslo for antenatal care from May 2008 to May 2010, and their offspring [14]. According to the National Guidelines for Antenatal Care women with a normal pregnancy should be cared for either by a midwife and/or a general practitioner. All care related to pregnancy and birth is free of charge. Prior to the study, the majority (75–85%) of pregnant women in the three municipalities attended the local Child Health Clinics for antenatal care. This proportion was probably higher during the study period, as local general practitioners were asked to remit pregnant women to the Child Health Clinics to be invited to participate in the study.

The study design has been presented in detail elsewhere [14]. In short, information material and questionnaires were translated to eight languages: Arabic, English, Sorani, Somali, Tamile, Turkish, Urdu and Vietnamese, covering the largest ethnic groups. Questionnaire data were collected by specially trained study midwives through interview, supported by a professional interpreter when needed. The study protocol was approved by The Regional Committee for Medical and

Health Research Ethics for South Eastern Norway, and The Norwegian Data Inspectorate. The women were eligible if they were: (1) living in one of the three municipalities, (2) would give birth at the study hospitals, (3) were in gestational week <20, (4) not suffering from diseases necessitating intensive hospital follow-up during pregnancy, (5) not already included in the study with a previous pregnancy lasting >22 weeks, (6) could communicate (orally) in Norwegian or one of the other eight languages, and (7) were able to provide informed written consent. Overall participation rate was 74% and the study cohort was representative for women attending the Child health Clinics with respect to ethnicity and age, and fairly representative with respect to parity [14].

2.2. Explanatory variables

Maternal and offspring ethnic origin was defined by the pregnant participant's country of birth. If the participant's mother was born outside Europe or North-America, country of origin was defined by the participant's mother's country of birth [15]. All women with non-European ancestry were either born or had mothers born outside Europe. In total 66 different countries were represented in this cohort. For the final analyses we chose to categorize ethnic origin into five groups (Table 1); Europe, South Asia, East Asia, Middle East/North Africa, including the Horn of Africa and Others. East Asia was here defined including all Asian countries not defined as South Asian or Middle East (Central Asia).

Table 1
Maternal and fetal characteristics.

	Europe n = 359	South Asia n = 191	East Asia n = 39	Middle East/N-Africa n = 153
Maternal age, mean (SD)	30.6 (4.5)	28.6 (4.5)	30.9 (4.5)	29.3 (5.4)
Primipara, n (%)	192 (54)	80 (42)	16 (41)	53 (35)
Married/cohabitant, n (%)	343 (96)	189 (99)	32 (82)	142 (93)
Educational level, n (%)				
University/college	230 (65)	62 (33)	14 (36)	25 (16)
High school	11 (31)	93 (49)	17 (44)	64 (42)
Primary school or less	15 (4)	35 (18)	8 (21)	63 (41)
Socioeconomic position score ^a	0.48 (0.88)	-0.17 (0.79)	0.06 (0.68)	-0.79 (0.99)
Paternal ethnicity same as maternal ^b	290 (92)	144 (98)	17 (55)	95 (98)
Born in Norway, n (%)	297 (83)	39 (20)	1 (3)	7 (5)
Years of residence in Norway, n (%)				
>20 years	306 (85)	50 (26)	11 (28)	22 (14)
5–20 years	29 (8)	95 (50)	18 (46)	86 (57)
<5 years	24 (7)	46 (24)	10 (26)	44 (29)
Smoking (pre-pregnant), n (%) ^c	109 (31)	4 (2)	3 (8)	14 (9)
Smoking (at inclusion, mean GW 15), n (%) ^c	30 (8)	1 (1)	1 (2)	3 (2)
Maternal height, cm, mean (SD)	167.1 (5.7)	160.2 (5.6)	156.9 (6.3)	161.9 (5.5)
Maternal pre-pregnant BMI, kg/m ² , mean (SD)	24.5 (4.8)	23.7 (4.1)	22.0 (2.8)	26.0 (5.6)
Gestational diabetes, n (%) ^d	39 (11)	28 (15)	6 (16)	20 (14)
Hypertensive complication in pregnancy ^e				
Mild	22 (6)	7 (4)	0	6 (4)
Severe	4 (1)	4 (2)	1 (3)	2 (1)
Gestational age at delivery ^f	280 (12)	277 (15)	277 (12)	279 (11)
Gender, boy, n (%)	182 (53)	99 (53)	20 (56)	61 (42)
Breech position at birth, n (%)	14 (4)	10 (5)	4 (10)	2 (1)
Birth weight, mean (SD)	3568 (544)	3222 (541)	3201 (563)	3451 (524)
Small for gestational age (SGA) ^g	31 (9)	45 (24)	10 (26)	25 (17)
Large for gestational age (LGA) ^g	37 (10)	6 (3)	0	12 (8)

Europe (Norway 83%, other Western European countries 6%, Eastern Europe 11%), South Asia (Pakistan 63%, Sri Lanka 30%, India 6%), East Asia (largest groups: Vietnam 44%, The Philippines 28% and Thailand 13%), Middle East/North Africa, including the Horn of Africa (largest groups: Iraq 22%, Somalia 22%, Turkey 17% and Morocco 16%) and Others (countries in South- and Central America and Africa south of Sahara).

^a Socioeconomic position; a score derived from a principal components analysis, including 11 individual and household sociodemographic variables (range –2.91 to 2.59).

^b Paternal self-reported ethnic origin, defined as country of birth or mothers country of birth (if mother born outside Europe). Missing in 13% of Europeans, 23% of South Asians, 21% of East Asians and 37% of Middle East/N-Africans.

^c Daily or occasional smoking.

^d Gestational diabetes diagnosed by universal screening by 1999 WHO-criteria: fasting glucose ≥ 7 mmol/L or 2 h glucose ≥ 7.8 mmol/L.

^e Hypertensive complications in pregnancy, categorized at birth, from hospital records. Severe hypertensive complications defined as preeclampsia or severe hypertension with large clinical implications (i.e. induction of birth), preeclampsia before gestational week 34, eclampsia or HELLP-syndrome.

^f Gestational age at birth, derived from the first day of the woman's last menstrual period (LMP).

^g Categorized according to Norwegian national gender- and gestational week-specific birth weight references.

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