INTRODUCTION

Low birthweight has been associated with increased morbidity and mortality in childhood, and also in adult life.\(^1\)\(^-\)\(^4\) Low birthweight is considered a significant global health problem, and the World Health Organization has a goal of 30% reduction in the occurrence of low birthweight by 2025.\(^5\) Such a goal assumes that low birthweight is caused by modifiable factors.

Offspring birthweight and placental weight in immigrant women from conflict-zone countries; does length of residence in the host country matter? A population study in Norway

Anne Eskild\(^1,2\) | Silje Sommerfelt\(^1,2\) | Irene Skau\(^3\) | Jostein Grytten\(^1,3\)

\(^1\)Division of Obstetrics and Gynecology, Akershus University Hospital, Lørenskog, Norway
\(^2\)Institute of Clinical Medicine, University of Oslo, Oslo, Norway
\(^3\)Department of Community Dentistry, University of Oslo, Oslo, Norway

Correspondence
Anne Eskild, Division of Obstetrics and Gynecology, Akershus University Hospital, 1478 Lørenskog, Norway. Email: anne.eskild@medisin.uio.no

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Abstract

Introduction: We aimed to estimate differences in offspring birthweight and placental weight between Norwegian women and immigrants in Norway from countries with armed conflicts. We also studied whether length of residence in Norway was associated with offspring birthweight and placental weight.

Material and methods: We included in our study all singleton births in Norway at gestational week 28 or beyond during the years 1999-2014, to mothers who were born in Somalia, Afghanistan, Iraq (total immigrants \(n = 18\) \(817\)), or Norway (\(n = 668\) \(439\)). Data were obtained from The Medical Birth Registry of Norway and the Central Person Registry of Norway. We estimated the differences between Norwegian and immigrant women in mean offspring birthweight and mean placental weight by applying linear regression analyses. Adjustments were made for maternal age, parity, year of delivery, gestational age at delivery, preeclampsia, and diabetes.

Results: The immigrant women had 206 g (95% CI 199 to 213 g) lower mean offspring birthweight and 16 g (95% CI 14 to 18 g) lower mean placental weight than Norwegian women. Immigrant women with \(\geq 5\) years of residence in Norway had higher offspring birthweight (40 g) and higher placental weight (17 g) than immigrant women with <5 years of residence.

Conclusions: Immigrant mothers from Somalia, Afghanistan, and Iraq gave birth to infants and placentas with lower weight than Norwegian women. However, the difference between Norwegian women and immigrant women was reduced by length of residence in Norway.

KEYWORDS
birthweight, immigrants, placental weight, population study, refugees

1 | INTRODUCTION

Low birthweight has been associated with increased morbidity and mortality in childhood, and also in adult life.\(^1\)\(^-\)\(^4\) Low birthweight is considered a significant global health problem, and the World Health Organization has a goal of 30% reduction in the occurrence of low birthweight by 2025.\(^5\) Such a goal assumes that low birthweight is caused by modifiable factors.
Immigrants from non-western countries represent an increasing proportion of women who give birth in Europe and the USA, and women from Africa and Asia give birth to offspring with lower birthweight than native women. Such differences in birthweight have partly been attributed to genetic factors, and it has been suggested that ethnicity-specific fetal growth centiles should be used to better identify the pregnancies and offspring with true increased risk of adverse outcome.

A counter argument for ethnicity-specific growth centiles has been that the lower offspring birthweight in immigrants is caused by poor living conditions, and that poor living conditions for the mother compromise fetal growth. If this is true, it is to be expected that improvements of deprived women’s living conditions will lead to higher offspring birthweight. Hence, long-term residence in an affluent country for women emigrating from deprived regions could possibly increase their offspring’s birthweight. However, a study from Sweden found only marginal changes in offspring birthweight with the immigrants’ duration of residence. Another study from the USA reported an initial decline in offspring birthweight after immigration. Changes in offspring birthweight after emigration could possibly depend on the level of change in living conditions. Particularly, women who live in an armed conflict region may have been exposed to deprived living conditions and thus be at high risk of giving birth to a low-birthweight infant.

The placenta is essential for fetal growth and development. Placental dysfunction may therefore impair fetal growth, and a small placenta could indicate impaired placental function. We are not aware of any studies of placental weight in immigrants or of changes in placental weight by duration of residence in a host country.

In the present study, we compared offspring birthweight and placental weight in women from Somalia, Iraq, and Afghanistan who gave birth in Norway, with Norwegian women. We also studied birthweight and placental weight according to length of residence in Norway.

2 MATERIAL AND METHODS

2.1 Study design and study sample

We performed a population-based registry study in Norway during the years 1999-2014 by using data from the Medical Birth Registry and the Central Person Registry of Norway. Almost all births in Norway take place in hospitals, and antenatal and obstetric care is free of charge. All births have been compulsorily notified to the Medical Birth Registry since 1967.

Women from countries with armed conflict who gave birth in Norway in gestational week 28 and beyond were included, as well as births to Norwegian mothers. Somali, Iraqi, and Afghan women represented the largest immigrant groups from countries with armed conflict, and women from these countries were therefore included. Information about the women’s country of birth and length of residence in Norway was obtained by individual linkage between the Medical Birth Registry and the Central Person Registry of Norway using the women’s unique person identification numbers. All individuals with legal residence in Norway receive a unique person identification number. Women without legal residence, who give birth, receive a temporary person identification number. A woman was defined as Norwegian if both of her parents were born in Norway.

Placental weight has been reported to the Medical Birth Registry since 1999. Therefore, our study period started in 1999.

A total of 711 073 births were eligible for our study (Figure 1). We excluded births with missing information about birthweight (n = 375), placental weight (n = 22 648), parity (n = 0), and maternal age (n = 63). Additionally, a total of 740 births to immigrant women were excluded because of missing information about length of residence in Norway. Hence, a total of 687 247 births could be included in our data analyses, representing 668 439 Norwegian, 9281 Somali, 2113 Afghan, and 7423 Iraqi women.

2.2 Study factors

Our outcome variables were birthweight and placental weight, in grams. According to obstetric standards in Norway, the placenta is weighed at the obstetric ward with membranes and umbilical cord attached, within 1 hour after delivery.

Birthweight and placental weight may be associated with maternal age, parity, year of delivery, gestational age at delivery, maternal diabetes, and preeclampsia, and these factors may also be associated with country of birth. We therefore made adjustment for these factors, and the information was obtained from the Medical Birth Registry. Maternal age at delivery was coded as ≤20, 20-34, or ≥35 years old, parity was coded as none, 1, 2, or 3 or more previous deliveries. Year of delivery was coded as 1999-2002, 2003-2006, 2007-2011, or 2011-2014. Gestational age at delivery was coded as 28-36 weeks, 37-41 weeks, or ≥42 weeks. Maternal diabetes was reported to the Medical Birth Registry as diabetes mellitus type 1, diabetes mellitus type 2, gestational diabetes, and unspecified diabetes, and was coded in our analyses as diabetes (yes or no). Preeclampsia was defined as blood pressure 140/90 mm Hg or higher after 20 weeks of gestation in addition to proteinuria (more than 0.3 g/24 h or +1 on dipstick). Length of residence in Norway was coded as <5 years or ≥5 years.

2.3 Statistical analyses

Mean birthweight and placental weight according to the women’s country of birth were calculated, and differences in mean were tested by applying Student’s t test. We used crude and multivariable linear regression analyses to estimate differences by country of birth in birthweight (in grams) and in placental weight (in grams), with 95% CI,
using births to Norwegian women as the reference group. In multivariable analyses, we made adjustments for maternal age, parity, year of delivery, gestational age at delivery, diabetes, and preeclampsia. First, we studied all women. Thereafter, we studied immigrant women with <5 years and ≥5 years of residence in Norway, separately.

2.4 | Ethical approval

This research project was approved by the Norwegian Regional Committee for Medical and Health Research Ethics (reference number 2012/1433).

3 | RESULTS

Immigrant women from Somalia, Afghanistan, and Iraq represented an increasing proportion of the women who gave birth in Norway during our study period, from 1.3% in 1999-2002 to 3.9% in 2011-2014 (Table 1). Immigrant women were more often multiparous than Norwegian women. They had higher prevalence of diabetes, but lower prevalence of preeclampsia.

3.1 | Birthweight

Mean birthweight was 3578 g for offspring of Norwegian women, but in offspring of immigrant women, birthweight was 171 g lower, on average (Table 2; Figure 2). After adjustment for maternal age, parity, gestational week at delivery, year of delivery, diabetes, and preeclampsia, the difference in offspring birthweight between immigrant women and Norwegian women increased, and birthweight was estimated to be 206 g lower in immigrants than among Norwegian women. Offspring of Somali women had the lowest crude birthweight, at 185 g below the Norwegian mean, and the adjusted difference in birthweight was 245 g below the Norwegian mean (Table 2).
Immigrant women with ≥5 years of residence in Norway had higher offspring birthweight than immigrant women with shorter length of residence (Table 2). Women from Afghanistan had the greatest increase in offspring birthweight according to length of residence, and mean offspring birthweight was 66 g higher in Afghan women with 5 or more years of residence compared with Afghan women with shorter length of residence (Table 2; Figure 2).

| TABLE 1 | Characteristics of 687,247 singleton deliveries in Norway during the years 1999-2014, according to the women's country of birth |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Norway, % (n) | Immigrants, total % (n) | Somalia, % (n) | Afghanistan, % (n) | Iraq, % (n) |
| Total (n) | 668,439 | 18,817 | 9,281 | 2113 | 7423 |
| Maternal age at delivery (y) | | | | | |
| <20 | 2.36 (15,789) | 2.55 (480) | 2.83 (263) | 1.99 (42) | 2.36 (175) |
| 20-34 | 81.01 (541,482) | 79.82 (15,019) | 79.75 (7402) | 83.67 (1768) | 78.80 (5849) |
| ≥35 | 16.63 (111,159) | 17.63 (3318) | 17.41 (1616) | 14.34 (303) | 18.85 (1399) |
| Parity | | | | | |
| 0 | 41.57 (277,895) | 28.13 (5293) | 22.90 (2125) | 32.94 (696) | 33.30 (2472) |
| 1 | 36.50 (243,948) | 25.66 (4828) | 21.60 (2005) | 27.12 (573) | 30.31 (2250) |
| 2 | 16.21 (108,339) | 18.54 (3488) | 18.23 (1692) | 18.55 (392) | 18.91 (1404) |
| 3+ | 5.72 (38,250) | 27.68 (5208) | 37.27 (3459) | 21.39 (452) | 17.47 (1297) |
| Year of delivery | | | | | |
| 1999-2002 | 25.63 (171,324) | 12.02 (2262) | 12.69 (1178) | 4.69 (99) | 13.27 (985) |
| 2003-2006 | 24.86 (166,176) | 24.11 (4536) | 22.95 (2130) | 19.64 (415) | 26.82 (1991) |
| 2007-2011 | 25.51 (170,504) | 29.73 (5595) | 29.71 (2757) | 30.67 (648) | 29.50 (2190) |
| 2011-2014 | 24.00 (160,428) | 34.14 (6424) | 34.65 (3216) | 45.01 (951) | 30.41 (2257) |
| Gestational age at delivery (wk) | | | | | |
| 28-36 | 5.04 (33,694) | 4.74 (892) | 4.65 (432) | 4.59 (97) | 4.89 (363) |
| 37-41 | 88.28 (590,073) | 86.31 (16,241) | 82.44 (7651) | 90.58 (1914) | 89.94 (6676) |
| ≥42 | 6.68 (44,663) | 8.95 (1684) | 12.91 (1198) | 4.83 (102) | 5.17 (384) |
| Diabetes | | | | | |
| No | 99.31 (663,807) | 99.09 (18,645) | 99.08 (9196) | 99.15 (2095) | 99.07 (7354) |
| Yes | 0.69 (4623) | 0.91 (172) | 0.92 (85) | 0.85 (18) | 0.93 (69) |
| Preeclampsia | | | | | |
| No | 96.40 (644,343) | 97.51 (18,349) | 96.99 (9002) | 98.06 (2072) | 98.01 (7275) |
| Yes | 3.60 (24,087) | 2.49 (468) | 3.01 (279) | 1.94 (41) | 1.99 (148) |
| Length of residence in Norway (y) | | | | | |
| <5 | n/a | 53.56 (10,078) | 48.73 (4522) | 63.74 (1347) | 56.70 (4209) |
| ≥5 | n/a | 46.44 (8739) | 51.28 (4759) | 36.25 (766) | 43.30 (3214) |

3.2 | Placental weight

Mean placental weight was 675 g in Norwegian women. Immigrant women had lower placental weight, on average at 7 g lower than the Norwegian mean (Table 2; Figure 2). After adjustment for the above study factors, the difference between immigrant women and Norwegian women increased, and mean placental weight was estimated to be 16 g lower in immigrant women. Afghan women had the lowest crude mean placental weight, at 17 g below the Norwegian mean. After adjustment, placental weight in Afghan women was estimated to be 20 g below the Norwegian mean (Table 2).

Immigrant women with ≥5 years residence in Norway had higher placental weight than immigrant women with shorter length of residence (Table 2; Figure 2). In immigrants, the placenta was 24 g less than the Norwegian mean after <5 years of residence, and the placenta was 7 g less than the Norwegian mean after ≥5 years of residence (17 g increase). Women from Afghanistan had the greatest increase in mean placental weight, an increase of 20 g. Interestingly, mean placental weight in Afghan and Iraqi women with ≥5 years of residence in Norway was not significantly different from the Norwegian mean (Table 2; Figure 2). The increase in placental weight by length of residence was relatively larger than for birthweight.
We found that offspring birthweight and placental weight were lower among Somali, Afghan, and Iraqi women than among Norwegian women, but the difference was reduced by length of residence in Norway.

We are not aware of any previous population study that has compared birthweight and placental weight in immigrant women from conflict zones with native women in a European country.

We aimed to include all women from Norway, Somalia, Afghanistan, and Iraq who gave birth to a singleton infant in Norway during the years 1999-2014. We used data from the Medical Birth Registry of Norway, and all births in Norway are reported by law to this registry. In total, 23 826 (3.35% of total) of all eligible births in the Medical Birth Registry could not be included because of missing information about study factors. However, there was little difference in non-inclusion between women from the different countries (3%-7%). Missing information about placental weight was the most common reason for non-inclusion, independent of the women's country of birth, and very few women were excluded because of missing information about length of residence in Norway. Skewed selection to the study sample is therefore not a likely source of bias.

We made adjustments for maternal age, parity, year of delivery, gestational age at delivery, diabetes, and preeclampsia. Offspring birthweight and placental weight are known to be positively associated with maternal body mass index.

Both birthweight and placental weight increase by gestational age at delivery. In our study, the association was more pronounced in women with lower birthweight and placental weight in the USA than in those of European origin. However, two studies from Australian study showed higher placental weight in women who have recently immigrated to Australia than in those of European origin. In agreement with our results, several previous studies report that immigrant women from developing countries give birth to infants with lower birthweight and placental weight than the general population. Unfortunately, we had no information about maternal body mass index in our study. Therefore, the selection of women with a high body mass index could bias our results. We made adjustments for maternal body mass index.

In the Medical Birth Registry of Norway, all births in Norway are reported by law to this registry. In total, 23 826 (3.35% of total) of all eligible births in the Medical Birth Registry could not be included because of missing information about length of residence in Norway. Skewed selection to the study sample is therefore not a likely source of bias.

4. DISCUSSION

We found that offspring birthweight and placental weight were lower among Somali, Afghan, and Iraqi women than among Norwegian women. However, the difference was reduced by length of residence in Norway.

We are not aware of any previous population study that has compared birthweight and placental weight in immigrant women from conflict zones with native women in a European country. We aimed to include all women from Norway, Somalia, Afghanistan, and Iraq during the years 1999-2014. We used data from the Medical Birth Registry of Norway, and all births in Norway are reported by law to this registry. In total, 23 826 (3.35% of total) of all births in Norway were reported by law to the Medical Birth Registry. In total, 23 826 (3.35% of total) of all births were reported by law to the Medical Birth Registry. Therefore, the results are not subject to selection bias.

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infants in the USA found no difference in placental weight according to ethnicity.37 A Canadian study suggested increasing risk of pre-eclampsia according to length of residency in Canada.38

We are aware of four previous studies that have addressed whether length of residence in a host country is associated with offspring birthweight. Neither a Swedish nor a Canadian study found significant trends in offspring birthweight by length of residence.18,39 However, two studies from the USA found low offspring birthweight among the women with the shortest and the longest lengths of residence.19,40 For those women, the standard of living may not have increased after immigration.

It is under discussion whether the observed differences in birthweight between ethnic groups are caused by genetic differences,33,41,42 or by differences in intrauterine exposures.16,32,43,44 A study from the USA found an association between low birthweight and foreign-born status, as well as with educational level.45 Also, a Swedish study suggests that the mother’s ethnicity does not sufficiently explain the differences in offspring birthweight between mothers born in Sweden and mothers born in developing countries.46 A systematic review concluded that immigrant status in itself is not a good marker for risk of adverse perinatal outcomes.5

Besides maternal nutritional status, exposure to stress may also influence birthweight.47 Our findings suggest that settlement in a welfare state, such as Norway, may gradually have improved the immigrant women’s nutritional status and reduced their level of stress, and thereby the potentials for offspring intrauterine growth may have improved. The increasing offspring birthweight with length of residence in Norway therefore suggests that ethnicity-specific fetal growth charts made at one point in time, may not be valid at another point in time. Our findings question the usefulness of ethnicity-specific fetal growth charts.48

5 | CONCLUSION

Immigrant mothers in Norway from Somalia, Afghanistan, and Iraq had lower offspring birthweight and placental weight than Norwegian mothers. This difference was reduced by length of residence in Norway. Our findings suggest that changes in living conditions may influence birthweight and placental weight, and that valid ethnicity-specific fetal growth centiles may be difficult to establish.

CONFLICT OF INTEREST

There are no conflicts of interest.

ORCID

Anne Eskild https://orcid.org/0000-0002-2756-1583
Irene Skau https://orcid.org/0000-0003-1212-9162
Jostein Grytten https://orcid.org/0000-0002-7946-6385

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