




Comparison of weight and length at birth of non-Roma and Roma newborn in Serbia

Sandra Stanković  · Saša Živić · Aleksandra Ignjatović · Mariola Stojanović · Dragan Bogdanović · Sonja Novak · Jelena Vučić · Miodrag Stanković · Ljiljana Šaranac · Cvetković Vesna · Predrag Miljković · Ivana Vorgučin

Received: 23 December 2014/Revised: 29 August 2015/Accepted: 31 August 2015/Published online: 5 September 2015
© Swiss School of Public Health (SSPH+) 2015

Abstract

Objectives Roma infants tend to be smaller and are diagnosed as SGA more often than non-Roma infants, suggesting that specific anthropometric norms for these infants may be useful. We aimed to construct population-based centile, gender-specific charts for birth weight and length for singleton Roma infants born from 35 to 42 weeks of gestation and to compare it with anthropometric data of non-Roma infants.

Methods We analyzed data on 27,602 non-Roma (53 % males) and 2235 Roma (51 % males) singleton live infants delivered from 2006 to 2012 in South East Serbia. The LMS method was used to estimate the birth weight and length centiles.

Results Roma infants were up to 12 % lighter and up to 4 % shorter than non-Roma infants. Estimated centile charts for Roma males and females were constructed showing the 3rd, 10th, 25th, 50th, 75th, 90th and 97th centiles.

Conclusions We created the separate centile charts for Roma ethnic group. The sample size was sufficient to demonstrate differences in mean birth weights and lengths of at term infants born during the study period.

Keywords Roma · Birth weight · Birth length

S. Stanković (✉) · S. Živić · J. Vučić · M. Stanković · L. Šaranac · C. Vesna · P. Miljković
Children Clinic, Clinical Center Niš, Bul. Dr Z.Djindjica 48a,
18000 Nis, Serbia
e-mail: stankovic_sandra@yahoo.com

A. Ignjatović · M. Stojanović · D. Bogdanović · S. Novak
Institute of Public Health, Nis, Serbia

I. Vorgučin
Institute for Children and Youth, Novi Sad, Vojvodina, Serbia

Introduction

Small for gestational age (SGA) newborns are heterogeneous group including constitutionally small infants and those who have failed to reach their full genetic growth potential because of various problems (Baketteig 1998). Similarly, the large for gestational age (LGA) group comprises normal infants who are constitutionally large and those who are large due to a pathological antenatal growth model (Das and Sysyn 2004). Neonate is defined as SGA when his or her weight and/or length are below the 10th, 5th or 3rd centile of the appropriate neonatal chart, and LGA when his/her anthropometric values are above 90th centile. Small for gestational age as well as infants born large for gestational age are at increased risk of short and long-term health problems, so it is very important to identify SGA and LGA infants accurately (Paz et al. 1993; Baker et al. 2008; Das et al. 2009).

Romanies are an ethnic group, originating in India and arriving in Europe around fourteenth century. They represent the third largest minority in Serbia. Although the census from 2002 revealed that approximately 1.8 % of all inhabitants claim themselves to belong to Roma nationality, it is estimated that their actual number is several fold higher (Raduski 2009). Roma population differs from the majority population in Serbia not only by their origin, but also by its lifestyle, health, and social status. Socioeconomic status, education level, and health of the Roma people are significantly below the country standards implying the poverty they live in and extremely low quality of life (Cook et al. 2013; Balázs et al. 2012).

Several publications (Bobak et al. 2005; Varga et al. 2005) and observations by members of our medical staff in their daily work have revealed that Roma infants tend to be smaller and are diagnosed as SGA more often than non-Roma infants, suggesting that specific anthropometric

norms for these infants may be useful. When plotted on birth weight charts that are currently used in our country (Alexander et al. 1996; Durutović-Gligorović 2000), they can be misclassified as a small for gestational age. Similarly, large for gestational age infants can be misclassified also.

So we aimed in this study to construct population-based centile, gender-specific charts for birth weight and birth length for singleton Roma infants born from 35 to 42 weeks of gestation and to compare it with anthropometric data of non-Roma infants. We also intend to estimate the percent of the misclassification of Roma infants as SGA or LGA.

Methods

We analyzed data on 33,121 singleton live infants delivered from 2006 to 2012 in three maternity wards in South East Serbia (Niš, Prokuplje and Aleksinac). Data were obtained from the computerized birth files of the National Institute of Health. Information regarding ethnicity was self-reported by the parents and recorded on the birth certificate. Weight was measured using a mechanical scale. Length from crown to heel was measured using a non-stretched tape after extending the legs with the infant supine on the examining table.

The gestational age had been calculated in completed weeks based on the last menstrual period and/or early date ultrasound and/or neonatal examination. Infants with major congenital anomalies, those with uncertain gestational age as well as newborns born before 35th week of gestation were excluded.

The LMS method was used to estimate the birth weight and length centiles. The L (Box-Cox power), M (median) and S (coefficient of variation) parameters were estimated (Cole 1988). This method uses smoothed values of L, M and S to transform the observed distribution of birth weights and lengths to a standard normal distribution. This allows the calculation of centiles by using the appropriate SD score. The scatter data plots and Z scores obtained from the LMS method were used to identify the outliers. Observations lying beyond ± 3 Z score were deleted.

Centiles were calculated using the LMS Chart Maker Light 2.54 version software and the other analyses was carried out using SPSS, version 16.

Ethical approval to proceed without individual consent was given on the basis that this was a retrospective anonymous clinical dataset.

Results

The inclusion criteria met 27,602 non-Roma (53 % males) and 2235 Roma newborns (51 % males). There was higher rate of prematurity in Roma group 10.5 vs 5.4 %.

Table 1 Number of non-Roma Serbian and Roma infants by their sex, ethnicity and gestational age (Serbia, 2014)

Gestational age (weeks)	Non-Roma Serbian		Roma	
	Males	Females	Males	Females
35	150	116	33	22
36	323	301	56	44
37	679	642	84	96
38	1835	1615	206	190
39	3262	2960	239	229
40	6254	5909	465	437
41	1510	1561	59	49
42	253	225	9	12

The number of non-Roma and Roma infants by their sex, ethnicity and gestational age is shown in Table 1. The gestation-specific smoothed birth weights and birth lengths on the 10th, 50th and 90th centiles for the Roma and non-Roma males and females are presented in Tables 2 and 3. Roma infants were significantly lighter (up to 12 %) (Table 2) and shorter (up to 4 %) (Table 3) than non-Roma infants through all gestational weeks except 35th and 36th for male, and 35th for female infants. Comparative non-Roma and Roma males and females centile birth weight and birth length charts were constructed showing the 3rd, 10th, 25th, 50th, 75th, 90th and 97th centiles (Figs. 1, 2, 3, and 4).

Discussion

In the studied population there was a difference in the birth weights and lengths among Roma and non-Roma infants. This difference was present during all studied gestational ages. Roma infants have lower birth weight and length than their non-Roma counterparts. The difference in birth weight seems to increase together with gestational age while the difference in birth length remains the same in all infants and this fact may indicate asymmetrical growth restriction. Data of anthropometric norms of Roma infants are scarce; there are only few publications available on this subject. However, our measurements were quite similar to those of Varga et al. (2005) and Bobak et al. (2005).

Many factors may affect birth weight (Gardosi et al. 2009; Kramer 1998; Wehby et al. 2015), so it is unclear whether smaller size of Roma infants is caused by ethnicity or by low socioeconomic and health status. Customized charts reflect constitutional factors, but are also surrogates for a combination of parameters related to the mother, such as socioeconomic level and nutrition (Gardosi et al. 2009). Nevertheless, the available data do not permit confident

Table 2 Smoothed birth weights for the Roma and non-Roma Serbian males and females with differences between the weights on the 10th, 50th and 90th centiles (Serbia, 2014)

Gestational age (weeks)	Birthweight (g)												p^{\dagger}	p^{\ddagger}						
	10th				50th				90th											
	Male		Female		Male		Female		Male		Female									
Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %									
35	2091	2078	0.6	1933	2027	-4.6	2600	2456	3.7	2506	2386	5.1	3063	2887	6.1	2968	2756	7.7	0.096	0.341
36	2321	2241	3.6	2179	2203	-1.1	2845	2660	3.7	2744	2577	6.5	3340	3126	6.8	3231	2990	8.1	0.299	<0.001
37	2552	2394	6.6	2332	2350	-0.7	3080	2853	3.8	2968	2754	7.8	3644	3354	9.2	3486	3212	8.5	<0.001	<0.001
38	2766	2531	9.3	2560	2470	3.5	3290	3021	3.8	3169	2919	8.6	3898	3560	9.5	3708	3421	8.4	<0.001	<0.001
39	2942	2639	11.5	2743	2565	6.9	3465	3146	10.1	3334	3065	8.8	4073	3726	9.3	3886	3599	8.0	<0.001	<0.001
40	3079	2733	12.7	2873	2640	8.8	3613	3246	11.3	3470	3173	9.4	4205	3873	8.6	4015	3721	7.9	<0.001	<0.001
41	3179	2815	12.9	2976	2691	10.6	3733	3330	12.1	3576	3244	10.2	4314	4001	7.8	4120	3788	8.8	<0.001	<0.001
42	3233	2891	11.8	3069	2725	12.6	3815	3406	12.0	3655	3295	10.9	4401	4123	6.7	4216	3832	10.0	0.014	0.006

\dagger p value, non-Roma Serbian vs Roma male

\ddagger p value non-Roma Serbian vs Roma female

Table 3 Smoothed birth lengths for the Roma and non-Roma Serbian males and females with differences between the lengths on the 10th, 50th and 90th centiles (Serbia, 2014)

Gestational age (weeks)	Birth length (cm)												p^{\dagger}	p^{\ddagger}						
	10th				50th				90th											
	Male		Female		Male		Female		Male		Female									
Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %	Non-Roma Serbian	Roma Diff %									
35	44.79	44.16	1.4	44.18	43.79	0.9	48.22	47.36	1.8	47.68	46.99	1.4	51.54	50.20	2.7	51.19	49.58	3.4	0.292	0.231
36	46.21	45.46	1.6	45.66	45.00	1.4	49.49	48.41	2.2	48.99	47.95	2.1	52.67	51.29	2.6	52.28	50.53	3.3	0.068	<0.001
37	47.62	46.67	2.0	47.07	46.12	2.0	50.76	49.49	2.5	50.22	48.90	2.6	53.80	52.40	2.6	53.30	51.51	3.2	<0.001	<0.001
38	48.87	47.60	2.6	48.26	47.11	2.4	51.89	50.40	2.9	51.26	49.80	2.0	54.79	53.35	2.6	54.16	52.45	3.2	<0.001	<0.001
39	49.80	48.18	3.2	49.17	47.84	2.7	52.75	51.07	2.0	52.05	50.53	4.0	55.54	54.05	2.7	54.82	53.21	2.9	<0.001	<0.001
40	50.44	48.60	3.6	49.80	48.32	3.0	53.37	51.64	3.2	52.61	51.06	2.9	56.10	54.61	2.7	55.30	53.73	2.9	<0.001	<0.001
41	51.03	49.03	3.9	50.31	48.50	3.6	53.98	52.18	3.3	53.11	51.34	2.0	56.67	55.11	2.7	55.76	53.97	3.2	<0.001	<0.001
42	51.58	49.46	4.2	50.72	48.38	4.6	54.54	52.70	3.1	53.53	51.36	3.3	57.21	55.59	2.8	56.16	53.93	4.0	0.036	0.010

\dagger p value, non-Roma Serbian vs Roma male

\ddagger p value non-Roma Serbian vs Roma female

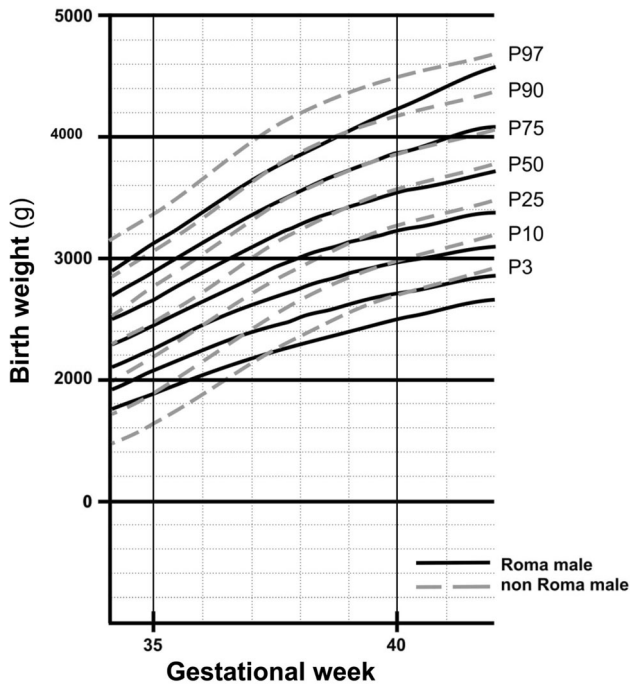


Fig. 1 Comparative 3rd, 5th, 10th, 50th, 75th, 90th and 97th centiles for Roma and non-Roma male birth weights (Serbia, 2014)

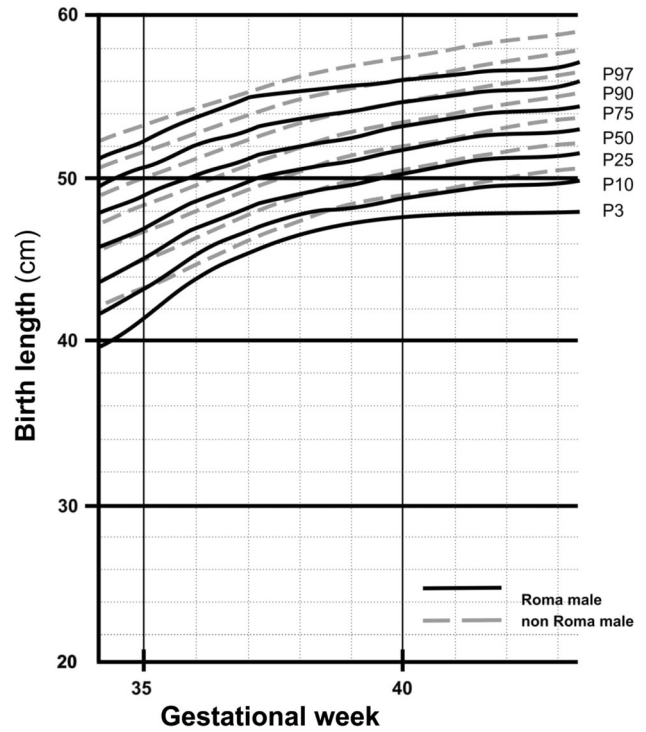


Fig. 3 Comparative 3rd, 5th, 10th, 50th, 75th, 90th and 97th centiles for Roma and non-Roma male birth lengths (Serbia, 2014)

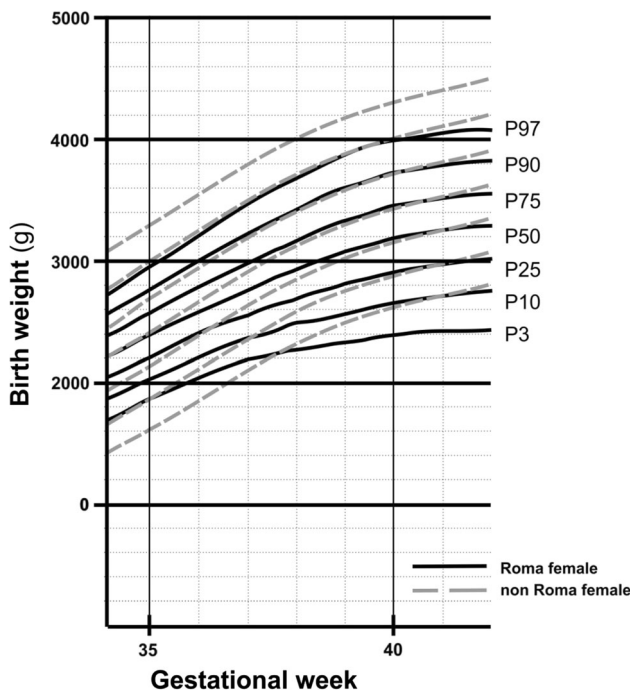


Fig. 2 Comparative 3rd, 5th, 10th, 50th, 75th, 90th and 97th centiles for Roma and non-Roma female birth weights (Serbia, 2014)

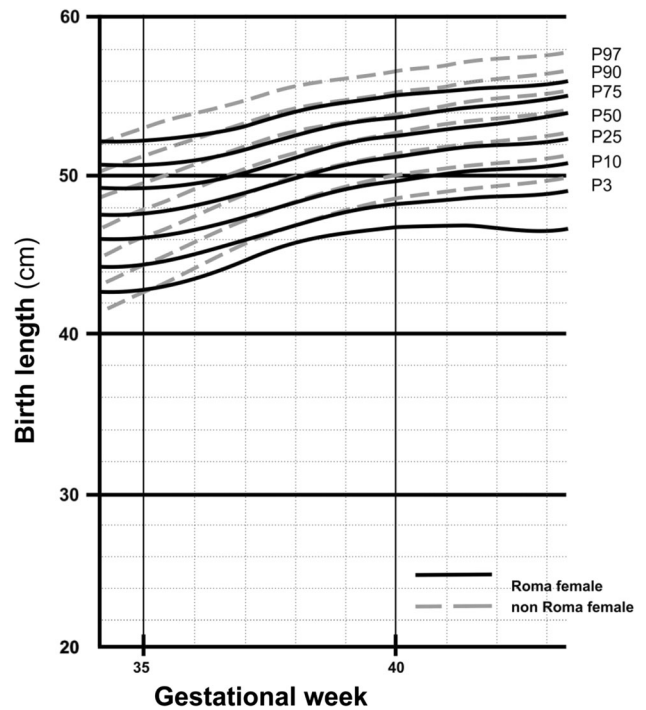


Fig. 4 Comparative 3rd, 5th, 10th, 50th, 75th, 90th and 97th centiles for Roma and non-Roma female birth lengths (Serbia, 2014)

inferences regarding the extent to which they induce physiological or pathological variations in fetal growth (Bertino et al. 2007).

Potential social determinants of the lower birth weight of Roma children are known. Due to multiples of various

limitations Roma are unable to attend school so their education level is very low. They are almost excluded from economic and social life, so constantly are caught in a

vicious circle of misery and poverty (Raduski 2009, Foldes and Covaci 2012). Recently published work by Balázs et al. (2014) demonstrated that Roma ethnicity may serve as a proxy for other unmeasured social or biological factors and should be considered as an important covariate for measurement among neonates.

In favor of the ethnicity impact to the anthropometric measures are the results of studies from the Indian population (Kandraju et al. 2014) and South Asian population living in Britain showing the similarity with the Roma population measures (Seaton et al. 2011; Ray et al. 2009).

There are several limitations to our study. Our data were provided from the routine care, so anthropometric measurements were done by different nurses and this may have contributed to the inter-observer variability. Also, our sample is limited and covers about 10 % of Roma population living in Serbia. However, Roma population fertility rate in Serbia is high. Cumulative fertility rate, which represents the average number of live births in women aged 50–54 years (Raduski 2009) is 3.03. Considering this fact there is enough data available to create the separate centile charts for Roma ethnic group. Although the sample size was sufficient to demonstrate differences in mean birth weights and lengths at term, the number of preterm infants born during the study period was not sufficient to establish reference ranges for infants in Roma group. This suggests that the large-scale population-based studies in the developed countries (Fenton and Kim 2013) might be the best way to estimate a fetal growth and centiles of preterm infants in this population.

References

- Alexander GR, Himes JH, Kaufman RB, Mor J, Kogan M (1996) A United States national reference for fetal growth. *Obstet Gynecol* 87:163–168
- Baker J, Olsen L, Sørensen T (2008) Weight at birth and all-cause mortality in adulthood. *Epidemiology* 19:197–203
- Bakketeig LA (1998) Current growth standards, definitions, diagnosis and classification of fetal growth retardation. *Eur J Clin Nutr* 52(Suppl 1):S1–S4
- Balázs P, Rákóczi I, Greczner A, Foley KL (2012) Risk factors of preterm birth and low birth weight babies among Roma and non-Roma mothers: a population-based study. *Eur J Pub Health* 23(3):480–485
- Balázs P, Rákóczi I, Greczner A, Foley KL (2014) Birth-weight differences of Roma and non-Roma neonates-public health implications from a population-based study in Hungary. *Cent Eur J Public Health* 22(1):24–28
- Bertino E, Milani S, Fabris C, Curtis MD (2007) Neonatal anthropometric charts: what are they and what are they not. *Arch Dis Child Fetal Neonatal Ed* 92:F7–F10
- Bobak M, Dejmeek J, Solansky I, Sram RJ (2005) Unfavorable birth outcomes of the Roma women in the Czech Republic and the potential explanations: a population-based study. *BMC Public Health* 5:106
- Cole TJ (1988) Fitting smoothed centile curves to reference data. *J R Stat Soc* 151:385–418
- Cook B, Wayne GF, Valentine A, Lessios A, Yeh E (2013) Revisiting the evidence on health and health care disparities among the Roma: a systematic review 2003–2012. *Int J Public Health* 58:885–911
- Das UG, Sysyn GD (2004) Abnormal fetal growth: intrauterine growth retardation, small for gestational age, large for gestational age. *Pediatr Clin N Am* 51:639–654
- Das S, Irigoyen M, Patterson M, Salvador A, Schutzman DL (2009) Neonatal outcomes of macrosomic births in diabetic and non-diabetic women. *Arch Dis Child* 94:419–422
- Durutović-Gligorović S (2000) Anthropometric newborn norms, 2nd edn. Medical Faculty, Belgrade
- Fenton TR, Kim JH (2013) A systematic review and meta-analysis to revise the Fenton growth chart for preterm infants. *BMC Pediatrics* 13:59. <http://www.biomedcentral.com/1471-2431/13/59>
- Foldes ME, Covaci A (2012) Research on Roma health and access to healthcare: state of the art and future challenges. *Int J Public Health* 57:37–39
- Gardosi J, Clausson B, Francis A (2009) The value of customised centiles in assessing perinatal mortality risk associated with parity and maternal size. *BJOG Int J Obstet Gynecol* 116:1356–1363
- Kandraju H, Agrawal S, Geetha K, Sujatha L, Subramaian S, Murki S (2014) Gestational age-specific centile charts for anthropometry at birth for South Indian infants. *Indian Pediatr* 24:199–202
- Kramer MS (1998) Socioeconomic determinants of intrauterine growth retardation. *Eur J Clin Nutr* 52(Suppl 1):S29–S33
- Paz I, Seidman DS, Danon YL, Laor A, Stevenson DK, Gale R (1993) Are children born small for gestational age at increased risk of short stature? *Am J Dis Child* 147:337–339
- Raduski N (2009) The Roma on the ethnodemographic map of Serbia. <http://www.doiserbia.nb.rs/img/doi/0352-5732/2009/0352-57320926041R.pdf>. Accessed 3 Nov 2014
- Ray J, Jiang D, Sgro M, Shah R, Singh G, Mamdami MM (2009) Thresholds for small for gestational age among newborns of East Asian ancestry. *J Obstet Gynaecol Can* 31:322–330
- Seaton S, Yadav KD, Field DJ, Khunti K, Manktelow BN (2011) Birthweight centile charts for South Asian infants born in the UK. *Neonatology* 100:398–403
- Varga I, Neščakova E, Bauer F, Pospíšilova V, Toth F, Drobna H, Mičieta V (2005) Morphology in full-term physiological neonates of Romanians from western Slovakia. *Acta Medica Martiniana* 5:10–15
- Wehby GL, Gili JA, Pawluk M, Castilla EE, Lopez-Camelo JS (2015) Disparities in birth weight and gestational age by ethnic ancestry in South American countries. *Int J Public Health* 60:343–351