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## ANTHROPOMETRIC CHARACTERISTICS OF ROMA WOMEN POPULATION IN VIROVITICA-PODRAVINA COUNTY, CROATIA

**ABSTRACT:** *The aim of this study was to present and compare anthropometric characteristics of Roma pregnant women in Virovitica-Podravina County to the majoritarian non-Roma group. A retrospective study on deliveries of Roma women at the Maternity Ward of the General Hospital Virovitica, Croatia, was carried out in the period from 1991 to 2010. The study included 204 Roma and 408 non-Roma pregnant women. The values analysed were prepregnancy body weight and height, body mass index (BMI), body weight before delivery, gestational weight gain (GWG) and external dimensions of the pelvis. Roma women give birth while being on average younger, 7.6 cm smaller, 4.70 kg lighter at the beginning and 5.13 kg at the end of the pregnancy, compared to the non-Roma women. The values of BMI and GWG are similar in both groups, however a higher frequency of the underweight, overweight and obese pregnant women was found in the Roma group. All three outer dimensions of the pelvis (Distancia cristarum, spinarum and trochanterica) are on average 1 cm smaller in Roma group. The differences in anthropometric characteristics between Roma and non-Roma pregnant women in Virovitica-Podravina County can be explained by ethnical origin, interaction with environmental factors and lifestyle.*

**KEY WORDS:** *Roma women – Anthropometric characteristics – Pregnancy*

### INTRODUCTION

Roma people are the largest transnational ethnic minority group in Central and Eastern Europe of northern Indian origin (Grellmann 2005, Melegh *et al.* 2017). In Croatia, they settled down more than six

centuries ago (Vukanović 1983) and represent a national minority. The exact size of this population is not precisely known. According to the 2011 Census, 9463 individuals, i.e. 0.4 % of the total Croatian population, declared to be of Roma nationality (Anonym 2013). However, the number of Roma people

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in Croatia is estimated to be up to 60000–150000 people (Croatia Law Center 2012). A difficulty of determining the number of local Roma population arises in Podravina due to assimilation pressure and ethnomimicry. The 2011 Census reported 14 (0.02 %) individuals in Virovitica-Podravina County to declare themselves as Roma. In comparison with the Census, data from the Centre for Social Work is disproportionate, as it estimates the real number of Roma people in the small area of Podravina to be 1500 (Census of Population 2013, Hrvatić 2004).

History shows the Roma to be politically, economically and culturally marginalized and stigmatized. Roma people are more often employed in seasonal agricultural jobs, as well as collecting and trading secondary processed materials (Štambuk 2000, UNDP 2005, Janka *et al.* 2018). Nevertheless, the Roma population located in Virovitica-Podravina County successfully integrated and assimilated. It natively inhabits the area and speaks Croatian language. The economic status is also higher compared to the rest of Roma in Croatia. As a result, this population has lost its national identity (Vojak 2005, Škiljan, Babić 2014).

There is limited, not easily accessible literature on anthropometric characteristics of Roma women. Moreover, studies are small and the sampled population is therefore non-representative. Most of the studies come from Slovakia, Czech Republic, Hungary, Romania and Spain (Hajioff, McKee 2000, Bobak *et al.* 2005, Dolinska 2007, Rambousková *et al.* 2009, Macekova *et al.* 2010, Stojanovski *et al.* 2017). Recent reports on Roma in Croatia, especially about anthropometric characteristics on pregnant Roma women are sparse and incomplete (Zajc *et al.* 2006, Škarić-Jurić *et al.* 2007, Zeljko *et al.* 2008, Rodin 2010). The level of genetic differentiation of Roma population in Europe can be evaluated using genetic methods. Kalaydieva *et al.* (2001) analyzed data about classic polymorphisms of the Roma, European and north-Indian populations proving the Indian origin for the European Roma. A significant level of Roma genetic differentiation has been found, in comparison to an indigenous European population.

Body mass index (BMI) is used to define anthropometric characteristics in adults and categorize individuals regarding height/weight (Nuttall 2015). The nutritional and health status of a mother is determined by the gestational weight gain (GWG), as well as the perinatal outcome. A low weight gain, as well as an excessive one, may have negative effects on both

mother and child. Mechanisms that affect GWG are not fully understood. There is a positive between maternal age, BMI before pregnancy, energy intake and physical activity of women in pregnancy, and their GWG. There is a high incidence of pregnant women with excessive GWG, especially among overweight and obese women (Ebrahimi *et al.* 2015). Ethnic differences in inadequate GWG are associated with underweight and normal body weight before pregnancy and lower level of education. Even though most women start pregnancies with normal BMI, only a third of them have an adequate GWG (Headen *et al.* 2015). Poor health status is a common problem in the Roma groups. Roma women have the lowest values of body height and weight, hand, waist and hips perimeter as well as the lowest BMI values (Gualdi-Russo *et al.* 2015). There are many etiologic factors that significantly affect the forming of the female pelvis. The final shape of the female pelvis is determined by cultural (e.g. exposure of Roma women to greater physical activity during childhood and adolescence), environmental and genetic factors (Abitbol 1996).

The aim of this study is to present some of the anthropometric characteristics of Roma pregnant women of Virovitica-Podravina County, a population completely assimilated in majority non-Roma population. This study also compares the anthropometric characteristics of Roma and non-Roma pregnant women.

## MATERIAL AND METHODS

A conducted retrospective study included deliveries at the Maternity Ward of the General Hospital Virovitica, Croatia, in the period from January 1991 to December 2010. Throughout this period complete reports and a substantial amount of data necessary for the research were found. In the later period, especially last 5 years, considerably fewer reports of Roma births were observed (3 to 4 births per year). The complete sample included 612 deliveries, the number consisting of 204 deliveries of Roma, as well as of one delivery of non-Roma before and one after each Roma delivery (i.e. a total of 408 deliveries by a non-Roma).

The estimation of the Roma ethnicity was based on the usual residential address of Roma population in Virovitica-Podravina County including Pitomača, Kladare and Kloštar Podravski. As another factor surnames specific to only this population were used. The accuracy of the selection was afterwards

confirmed using the registers (The birth register 1893, The wedding register 1923, The deaths register 1912).

Data about the pregnant women was taken from the history of disease that are being stored in the archives of Maternity Ward of the General Hospital Virovitica. The data on the socio-economic characteristics was not found in these records and was thus not included in the study. At the beginning of nursing care in the hospital, body weight and height of pregnant women were measured using digital scale (1.0 kg accuracy) and anthropometric ruler (1.0 cm accuracy), respectively. Linen meter was used to measure the abdomen perimeter in centimeters. Data about the body mass at the beginning of the pregnancy was taken from maternity records. Pregnancy body mass index (BMI) was calculated using the standard formula:  $BMI (kg/m^2) = \text{Body weight (kg)} / [\text{Body height (m)}]^2$ . Relating to WHO recommendations, the sampled population was categorized into groups: BMI  $<18.5 \text{ kg/m}^2$  was defined as underweight, BMI  $18.5\text{--}24.9 \text{ kg/m}^2$  as normal weight, overweight was categorized as BMI  $25.0\text{--}29.9 \text{ kg/m}^2$  and obesity classed as BMI  $\geq 30.0 \text{ kg/m}^2$  (WHO 2004). Total gestational weight gain (GWG) was calculated by subtracting the prepregnancy weight from the last-measured weight before delivery. Regarding the GWG, pregnant women were separated into three groups:  $<8 \text{ kg}$  low GWG,  $8\text{--}16 \text{ kg}$  normal GWG and  $>16 \text{ kg}$  high GWG (Rasmussen, Yaktine 2009). Using Martin pelvimeter, outer measures of the pelvis in centimeters were determined. These measures can imply a possibility of small pelvis. A pelvis categorization according to size was made: narrow, normal and broad pelvis. The diameter of 25–26 cm for *Distancia spinarum* (the distance between the upper anterior iliac spines), 28–30 cm for *Distancia cristarum* (the distance between the most distant points of the iliac crests) and 32–33 cm for *Distancia trochanterica* (the distance between the big trochanters of the femurs) were defined as measures for a normally large pelvis. A narrow pelvis was defined as a pelvis that is two or more centimetres smaller for at least one of the diameters mentioned above, whereas a broad pelvis was defined as two or more centimeters broader for at least one of the diameters. (Cunningham *et al.* 2001). Gestational age was determined using Naegle's rule (Baskett, Nagele 2000) and was confirmed or corrected by the fetal ultrasonic biometry during pregnancy. After delivery, the gestational age was estimated using the method by Farr *et al.* (1966). Delivery was considered premature if it was carried out before 37 weeks of gestation ( $\leq 36^{+6}$  week). Delivery was considered to be

on time if carried out in the timespan from 37 to 42 weeks ( $37^{+0}$  until  $41^{+6}$  weeks included) while if carried out during the 42<sup>nd</sup> week or later, it was considered post-term delivery ( $\geq 42^{+0}$ ).

In this research, data was sampled in accordance with basic bioethical standards, ensuring privacy (medical secrets) of subjects involved in research and protection of data secrecy, in accordance with the Nuremberg Codex, the latest revision of the Helsinki Declaration (WMA 2011) and other relevant documents.

For qualitative variables, data is presented in absolute numbers and frequencies, whereas quantitative variables are represented using means and standard deviation. In addition to correlation analysis ( $R^2$ ), the significance while comparing normally distributed variables was proven using t-test, whereas for variables not showing normal distribution, non-parametric methods, such as  $\chi^2$ -test and Mann-Whitney test were used. The statistical significance was set to  $p < 0.05$ . The program used for statistical analysis was IBM's SPSS Statistics 19 package for Windows.

## RESULTS

During the analyzed period, from 1991 to 2010, there were 19318 deliveries in the maternity ward, 204 of them were of Roma women, i.e. 1.06% of the total number of deliveries. Some significant differences were found regarding the age of two older groups of women. Roma women were on average younger than non-Roma women ( $23.12 \pm 5.59$  vs.  $26.23 \pm 5.79$  year). Adolescent pregnancies were four times more common in Roma than in non-Roma women and predominated in the younger age groups, at the age of 13 to 19 (29.4% vs. 10.5%). In oldest group, at the age 35–43, non-Roma women were two times more frequent than Roma women (4.9% vs. 11.3%).

Table 1 shows mean body height and mass values, as well as indicators of nutritional status of Roma and non-Roma pregnant women. Roma women are on average 7.61 cm smaller. The average body mass value at the beginning of Roma pregnancies is 4.70 kg less, whereas the average body weight at childbirth is 5.13 kg less than the one of non-Roma women. The average value of prepregnancy BMI is comparable, while the GWG with Roma births is somewhat lower. The abdominal perimeter before a childbirth was 2.15 cm lower in Roma women versus non-Roma. There is a smaller incidence of normal weight in Roma

pregnant women. On the other hand, the incidence of inadequate weight: underweight, overweight and obese Roma women was higher compared to non-Roma women. The differences regarding the nutritional status were not statistically significant.

The differences regarding GWG during pregnancy between Roma and non-Roma women using three categories were not statistically significant. Adequate weight gain in pregnancy was less frequent, whereas an inadequate body weight gain was more common among Roma women, compared to non-Roma ones. GWG greater than 16 kg was equally present in both groups of women.

Differences in the correlations of anthropometric indicators of Roma and non-Roma women are shown in Table 2. In the Roma women group, significantly positive correlation of body weight with age and other

anthropometric variables was found. Correlations of these indicators in non-Roma pregnant women are similar to those of the Roma. In the non-Roma group age correlated significantly also with their body mass index and body height.

Differences in the size of the external dimensions of the pelvis of the Roma and non-Roma women were evaluated based on the values of the pelvic distances (Table 3). All three external dimensions of the pelvis width of Roma women are about one centimeter shorter and statistically significantly smaller (*Distantia spinarum* <0.94 cm, *Distantia cristarum* <0.98 cm, *Distantia trochanterica* <1.14 cm). All three pelvic distance parameters, which characterize the narrowed pelvis, are significantly more frequent in the case of Roma women, compared to non-Roma, whereas the category of normally broad pelvis is less frequent. Roma

TABLE 1: Average mean values of body height, weight and nutritional status of pregnant women.

	Roma (n = 204)	Non-Roma (n = 408)	p-value
Height (cm)	156.42 ±5.97	164.03 ±6.22	<0.001
Prepregnancy weight (kg)	56.29 ±10.30	60.99 ±11.16	0.001
Prepregnancy BMI (kg/m <sup>2</sup> )	22.97 ±3.79	22.64 ±3.79	0.481
Underweight (BMI <18.5)	11.2%	6.1%	0.133
Normal weight (BMI 18.5–24.9)	62.2%	75.0%	
Overweight (BMI 25.0–29.9)	20.4%	13.8%	
Obese (BMI ≥30)	6.1%	5.1%	
Weight at childbirth (kg)	69.80 ±12.95	74.93 ±11.71	0.001
Gestational weight gain (kg)	13.68 ±5.55	13.94 ±4.53	0.671
Low weight gain <8	13.4%	5.6%	0.054
Adequate weight gain 8–16	56.7%	66.3%	
Excessive weight gain >16	29.9%	28.1%	
Abdominal perimeter (cm)	99.79 ±8.58	101.94 ±7.74	0.003

TABLE 2: Correlations of anthropometric parameters of Roma and non-Roma women. Parameters: Age (years), BMI – Body mass index (kg/m<sup>2</sup>), Height (cm), PPW – Prepregnancy weight (kg), WAC – Weight at childbirth (kg), GWG – Gestational weight gain (kg). Grey colour p = 0.05, black colour p = 0.01.

	Roma						Non-Roma					
	Age	BMI	Height	PPW	WAC	GWG	Age	BMI	Height	PPW	WAC	GWG
Age	—	—	—	—	—	—	—	—	—	—	—	—
BMI	0.183	—	—	—	—	—	0.151	—	—	—	—	—
Height	0.189	0.030	—	—	—	—	0.187	0.063	—	—	—	—
PPW	0.268	0.903	0.416	—	—	—	0.224	0.852	0.425	—	—	—
WAC	0.271	0.735	0.518	0.898	—	—	0.176	0.729	0.466	0.904	—	—
GWG	0.099	0.032	0.394	0.221	0.595	—	0.033	0.122	0.187	0.007	0.364	—

TABLE 3: Differences of mean external dimensions of the pelvis and categories of pelvic dimensions of women.

Pelvis dimensions	Roma (n = 197)	Non-Roma (n = 408)	p-value
Distancia spinarum (cm)	24.42 ±1.19	25.36 ±1.09	<0.001
<25 cm	51.3%	18.4%	<0.001
25–26 cm	46.2%	72.8%	
>26 cm	2.5%	8.8%	
Distancia cristarum (cm)	26.84 ±1.41	27.82 ±1.21	<0.001
<28 cm	68.0%	34.8%	<0.001
28–29 cm	27.9%	58.6	
>29 cm	4.1%	6.6%	
Distancia trochanterica (cm)	29.96 ±2.24	31.10 ±1.97	<0.001
<32 cm	77.7%	61.5%	<0.001
32–33 cm	10.7%	26.7%	
>33 cm	11.7%	11.8%	

women were diagnosed with narrow pelvis three times more often (19.1% vs. 6.6%). Diagnosis of the narrow pelvis is, moreover, linked to two times higher frequency of fetopelvine disproportion.

Roma women gave birth significantly earlier (38<sup>+6</sup> vs. 39<sup>+4</sup> weeks) and had a higher incidence of premature births as well (9.3% vs. 2.2%).

## DISCUSSION AND CONCLUSION

The aim of this study was to compare anthropometric characteristics of pregnant women belonging to a fully assimilated Roma population, living in the area of Virovitica-Podravina County, to a majority non-Roma population. Data on the number of Roma living in Croatia is not available from the research done on the state level because of Roma hiding their ethnic identity (Rodin 2010). In this study, socio-economic factors were not investigated. However, compared to other groups of Roma living in other parts of Croatia, the investigated group of Roma in Virovitica-Podravina County lives in very good conditions, partially due to relatively high resource availability, e.g. trough better integration, spoken Croatian language, economic and residential situation, private entrepreneurship and trading (Štambuk 2000, UNDP 2005, Zelko *et al.* 2015).

Analyzed results of anthropometric measurements revealed significant differences in body height and body weight, BMI and weight gain during pregnancy in Roma, compared to non-Roma pregnant women

from Virovitica-Podravina County. Roma pregnant women are on average smaller, of lower prepregnancy body weight and before delivery, compared to non-Romas. Values of prepregnancy BMI, as an indicator of nutritional status, were somewhat higher in Roma pregnant women. The differences in nutritional status, compared to non-Roma pregnant women are, however, not significant. Body weight gain in Roma women is slightly lower than in non-Romas, also without any significant difference. In the two investigated groups, the nutrition status values were comparable.

Zajc *et al.* (2006) studied nutrition and nutritional status of the Bayash Roma population in the East of Croatia. Values of body height of Bayash women were below the 10<sup>th</sup> centile of the general population of eastern Croatia, whereas the body weight was approaching the values for 25<sup>th</sup> centile. Nutritional status, estimated based on BMI, is satisfactory up to the age of 35, after which the average BMI indicates overweight status. 11% of the Bayash population was underweight, 40% normal, 24% were overweight, while 25% were obese. Nutritional status of the Bayash is in general unsatisfactory and is the result of unhealthy eating habits and poor socioeconomic status, the main causes of which are poor education and high unemployment rates for members of this Roma population. With the increase in age, the average body height decreases, whereas the average body weight and BMI of the Bayash women increases. Compared to Bayash woman, Roma women from our investigation were of comparable height, on average of slightly lower weight and had somewhat larger BMI. They less

frequently had a normal weight and were more often underweight, overweight or obese, which may be associated with unhealthy eating habits of this Roma group as well.

Macekova *et al.* (2010) found, that according to BMI, 21.7 % of Slovakian Roma women are overweight and 28.3 % are obese. The mean value of BMI of Slovakian Roma women was 26.1. Similar data on nutritional status was also found in research on other Roma groups from Central European countries (Ginter *et al.* 2001, Valachovicova *et al.* 2003, Krajcovicova-Kudlackova *et al.* 2004). In the population of Roma women, the frequency of obesity often increases with age. The Roma, a minority in Slovakia, are very inhomogeneous. In the western parts of Slovakia, they have a relatively higher socioeconomic status and are integrated into the majoritarian population, while in the eastern parts it are poorer. The frequency of obesity in the Roma population in both regions is higher than that of the majoritarian population. Body height, weight and BMI in younger women in the poorer eastern region are lower. Surprisingly, the values of BMI in younger Roma women and in the poorer region are also higher than in the majoritarian population of women. This suggests that apart from economic and other factors, genetics may also play a role in the development of obesity (Dolinska *et al.* 2007).

Bobak *et al.* (2005) report anthropometric values of Roma and non-Roma mothers in the research on the outcome of Roma pregnancy in the Czech Republic. Roma mothers weighed on average 56.7 kg, were 159.4 cm tall and had BMI 22.4. They were significantly lighter and shorter than non-Roma women (on average 6.0 kg lighter and 6.8 cm shorter), while the difference between BMIs was not significant. Another study from the Czech Republic confirms, that Roma mothers are shorter and proportionately smaller (Rambousková *et al.* 2009). There is a great similarity in the values of the body measures of Roma women that were investigated in this study, compared to Czech Roma, as well as similar differences in physical measures between the Roma (ethnic) and non-Roma (majoritarian) group of women. Various groups of Roma women have similar values of bodily measures indicating their common origin. Half of the Roma population in the southern part of Romania, however, was found to have a high incidence of overweight and obesity as a result of negative lifestyle, sedentary lifestyle, smoking and lower socioeconomic status (Enache *et al.* 2016). Although genetic factors might

impact the differences in obesity prevalence between the Hungarian Roma and Hungarian general population reported in the literature, a more likely explanation are the ethnicity-related and environmental factors, shown in our investigation (Nagy *et al.* 2017). The higher incidence of overweight and obesity in the Roma population is found in other anthropometric studies (Poveda *et al.* 2014, Šedová *et al.* 2015). In our study, indicators of overweight and obesity were found more frequently in the Roma population.

Low values of body height and weight and insufficient nutrition are also present in women in southern India. The mothers weigh on average 51.2 kg, are 155 cm tall, and their BMI is 21.5. (Muthayya *et al.* 2006). Another study from India reports the prevalence of prepregnancy underweight women (42.2%) to be higher than the estimates for an average woman. Average prepregnancy BMI was 19.6 and GWG during pregnancy was low, on average about 7 kg for a full-term pregnancy. Poor maternal health among Indian women and lower nutrition status may explain this problem (Coffey 2015). For Indian pregnant women, the use of revised WHO criteria for BMI is recommended, where the prevalence of obesity is raised. Moreover, a part of the women in the low-risk category is shifted to the high-risk category (Aziz *et al.* 2014).

The weight of women at reproductive age, as well as excessive GWG, are major problems of perinatal care around the world. Studies indicate that women, that have excessive body weight or are obese before pregnancy, have a higher incidence of excessive GWG. Increased physical activity, on the other hand, has a protective effect (Samura *et al.* 2016). Hernandez *et al.* (2012) found, that women of lower socioeconomic status had a greater risk of excessive GWG. Vidakovic *et al.* (2015) suggest that obesity and excessive weight gain during pregnancy are associated with higher concentrations of fatty acids in the blood. A lower nutritional status of Roma mothers was associated with the less frequent use of dietary supplements, compared to the mothers of the majority population of the Czech Republic (Dejmek *et al.* 2002, Rambousková *et al.* 2009). Nevertheless, the significant differences in GWG between Roma and non-Roma pregnant Czech women were reported not to exist (Rambousková *et al.* 2003). Comparatively, in our research the differences in the distribution of GWG categories in pregnancies of Roma and non-Roma women were not significant either. Nevertheless, in Roma women low and excessive GWG were observed to be more frequent, whereas the normal GWG was less frequent.

In our study, significant differences in the size of the external dimensions of the pelvis of the Roma and non-Roma pregnant women were observed. The values of all three pelvis distances (*Distantia spinarum*, *Distantia cristarum*, *Distantia trochanterica*) in pregnant women were about one centimetre shorter. Likewise, the category of the narrow pelvis, determined by the values of all three distances, was more frequent in Roma pregnancies. Despite the ever-smaller application of classical pelvimetry in obstetric practice, pelvic measurements in our investigation point out to differences between Roma and non-Roma pregnant women, i.e. smaller pelvis in the Roma pregnant women. Cultural and environmental factors determined the female pelvis. A quarter of women has an android pelvis, but only a small part of them shows signs of hyperandrogenism, where also gynecoid and any other form of the pelvis can be found. Android pelvis is the most common consequence of women's exposure to greater physical activity during adolescence. The anthropoid pelvis is mostly a consequence to postponed upright posture beyond the normal age of 14 months, whereas platypelloid pelvis is more common due to upright posture before 14 months of age, i.e. premature walking. The exposure of Roma women to greater physical activity during childhood and adolescence may result in the development of the android pelvis, which is characterized by massive bones, narrower and longer sacrum, expressed triangular entry into the pelvis and sharper pubic angle (Abitbol 1996). Those are genetically conditioned and, consequently, have a significant effect on the way of childbirth. There are several publications that point to ethnic differences in the size and shape of the pelvis in women. Using computerized tomographic pelvimetry, for determination of basic parameters of the pelvis in Nigerian women, significant differences were found compared to the values of other studies, while anthropometric differences were related to the ethnic origin (Ma'aji *et al.* 2007). In a cohort study of Handa *et al.* (2008), using electromagnetic resonance for imaging of pelvic bones and pelvic structure, white women were found to have wider inlet and exit of the small pelvis, as well as a shallower anteroposterior exit in relation to African-American women. These differences can contribute to perceiving ethnic differences in obstetrical outcomes. According to a research of bone density in the Roma group in Croatia, Škarić-Jurić *et al.* (2006) found lower bone mass values in all age groups of Bayash women, which could be explained by the effects of body size and

structure or the influence of factors connected to the particular lifestyle and reproductive characteristics present in this semi-sedentary Roma population. Some studies suggest, that clinical and X-ray pelvimetry, as a routine practice in perinatal care, should be abandoned. In rare cases, it is recommended to use electromagnetic resonance and 3D pelvimetry with computerized tomography, as a supplement to clinical and ultrasound imaging in the estimation of fetopelvic disproportion (Salk *et al.* 2016).

Data from European countries indicates more frequent lower birth weight and premature birth in Roma women, compared to the non-Roma. Published data shows a higher incidence of premature births among Hungarian Roma women, compared to Hungarian non-Roma women (9.9 % vs. 7.1 %). Gestational age of the newborns was found to be lower (0.4 weeks) in Roma women, compared to non-Roma (Bobak *et al.* 2005, Balázs *et al.* 2013). In our study, a similar incidence of premature births was found. It was more frequent in Roma women, especially in late premature births (gestational age 35 to 35<sup>+6</sup> weeks).

The results of the study may be limited to this specific Roma population and may not be representative for the whole Croatian Roma population. Moreover, non-assimilated Roma were not considered. This limitation is very difficult to overcome, due to the unwillingness of many people to identify themselves as Roma. There are plenty of other factors that can be taken into consideration to provide a better picture for the explanation of ethnic differences of anthropometrical indicators like economic, material and living conditions, level of integration and maternal education.

There is sparse data on anthropometric characteristics of Roma, especially Roma pregnant women in Croatia. The aim of this study was to anthropometrically characterise a group of Roma women in Virovitica-Podravina County, which is completely assimilated and of a high standard of living, and compare it to the majoritarian non-Roma population. Significant differences in body weight, height and external dimensions of the pelvis were found between the two groups. Roma women are on average significantly smaller and have a significantly lower prepregnancy body weight, whereas BMI and GWG were also lower, however not significantly. There is also a higher incidence of an inadequate nutritional status in the Roma group, i.e. both underweight, overweight, as well as obese. The differences in anthropometric characteristics between the Roma and non-Roma pregnant women in Virovitica-Podravina County may be

explained by a number of effects – interaction with genetic, as well as environmental factors and life style of the populations with different ethnical origin. Of interest for future studies on anthropometric characteristics of Roma women may be socioeconomic factors, features of the traditional Roma life style, as well as a comparison with other Roma populations. These studies would be an advance for the development and implementation of preventive programs for this ethnic group.

## CONFLICTS OF INTEREST

The authors declared that they have no financial, professional or personal conflicting interests related to this article.

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