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Original article

Anthropometric indices of the newborns related with some lifestyle parameters of women during pregnancy in Tirgu Mures region – a pilot study

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Summary. *Objective:* We aim to study possible associations between lifestyle, socio-economic aspects, education and dietary habits during pregnancy and both the incidence of premature deliveries and anthropometric characteristics of newborns in different ethnic Romanian populations. *Methods:* This is a cross-sectional, questionnaire-based retrospective study applied on puerperal women from Tirgu-Mures, Romania. Anova and Kruskall Wallis were the statistical tests used. *Results:* Deficient intake of dairy products was found in the Romani women (69.50%), of red meat in Romanians (23.20%), of white meat in Hungarians (83.40) and Romanians (77.50%), of fish and eggs in Romani (91.30%) and Hungarian women (89.6%), of vegetables in Hungarian (93.80%) and the Romani women (91.3%) and of whole grain cereals in Romanian (93.40%) and Hungarian (95.50%) women. The water intake below the daily needs was found in 49.30% of Romanian women, 47.60% of Hungarian women and 100% of Romani women. An increased consumption of tobacco ($p<0.0032$) and alcohol ($p<0.0169$) was observed in the Romani women group. The level of education ($p<0.0001$) and the income ($p< 0.0001$) was significantly lower in the Romani women. The group of Romani women had a higher risk for a premature birth ($p<0.0013$). *Conclusions:* The Romani pregnant women presented a deficient diet and an inappropriate lifestyle for pregnancy. A group of Romani women who had newborns with a smaller birth weight and premature births was identified.

Key words: dietary patterns; pregnancy; premature delivery; ethnicity.

Introduction

Nutrition during pregnancy affects both maternal and fetal health state, but also the ulterior development of the child and young adult (1). A low quality diet during pregnancy has been associated with mother's weight excess, preeclampsia, premature delivery and even loss of pregnancy (2). Unhealthy alimentary habits of the mother during pregnancy affects the weight at birth of the newborn, parameter that it is associated with the frequency of chronic diseases of fetal origin developed during the child's future adult lifetime (3-5). These include arterial hypertension, coronary heart disease, diabetes mellitus and problems associated to bone matrix formation (6-12).

An experimental nutritional study on pregnant rat females showed that a low-protein diet it is correlated with an increased incidence of reduced weight

at birth for their cubs and with increase of the blood pressure, along with development of impaired glucose tolerance when they reach maturity. Similar results were obtained on guinea pigs and sheep. Same study showed that severe starvation of pregnant animals also generated small weight at birth and obesity and glucose intolerance when they became adults (9).

The mother's diet it is not the only factor that can influence the fetal intrauterine growth, on which the metabolic and endocrine status of the mother, umbilical blood flow and placental metabolism and transfer, respectively have also an important role (9).

There are studies which aimed to discover a correlation between the diet of the pregnant women and the results of newborns at birth (14-16). These have showed that a low-nutrients maternal diet due to high consumption of aliments rich in saturated fats, refined sugar and sodium has been associated with an increase of the frequencies of premature delivery and small weight and length at birth of newborns, respectively. On the contrary, a maternal diet rich in fruits, vegetables and whole grain cereals has been correlated with a reduced incidence of premature delivery and with higher weight and length at birth of the newborns (15-20).

In most of the studies, correlations have been made between diets based on one type of foods or nutrients and their influence on the maternal health and weight gain during pregnancy, but also on the anthropometric parameters of newborns. However, different aliments are not consumed separately and therefore, for evaluating the entire diet an evaluation of the dietary habits is needed.

Our objective is to study possible associations between lifestyle, socio-economic aspects, education and dietary habits during pregnancy and both the incidence of premature deliveries and anthropometric characteristics of newborns, in different ethnic Romanian populations.

Methods

This cross-sectional study was carried out in Tirgu Mures region on a period of twelve months, from March 2015 to March 2016, on one sample of 1275 puerperal women from three different maternities that serve the entire county: Obstetrics-Gynecology Clinic I of the Tirgu Mures Emergency Clinical County Hospital, Obstetrics-Gynecology Clinic II and the Nova Vita Medical Center of Tirgu Mures.

Our study was carried in an area of three ethnic populations (Romanians, Hungarians and Romani) and followed the local and ethnic particularities, from a socio-economical, educational, nutritional and behavioral perspective. Classifying the patients into standard diet types (omnivorous, Mediterranean, vegetarian) was hard to accomplish but pointing out the regional and ethnic particularities confers originality to this study.

The study protocol was approved by the Ethics Committee of University of Medicine and Pharmacy Tirgu Mures and the study was conducted in accordance with the Helsinki Declaration.

The including criteria in this study were: pregnant women from the Mures county admitted for delivery, written consent of puerperal women for participating in the study and complete filling out of the questionnaire that we have distributed to them.

The parameters followed in pregnant women were: age, ethnicity, body mass index (BMI) before pregnancy, weight gain during pregnancy, presence of a risky lifestyle behavior (tobacco consumption, daily consumption of more than two cups of coffee, weekly alcohol consumption, unbalanced diet, lack of home cooking), information regarding alimentation during pregnancy, the level of education, and the socio-economic status.

We have detailed the nutritional behavior starting from the diet profile during pregnancy (intake of dairy products, red meat, white meat, fish and eggs, fats, fresh fruits, fresh vegetables, leguminous plants, walnuts and seeds, pasta, cereals and bread, water and other liquids) and dietary informations received from the family physician or other sources.

The parameters followed in newborns were: weight for length score for boys, weight for length score for girls, weight for age score for boys, weight for age score for girls, length for age score for boys, length for age score for girls, APGAR score (median, range), premature delivery (< 37 gestational age). We interpreted these parameters according to WHO standards.

All of these data were recorded using a questionnaire approved by the Ethics Committee of The University of Medicine and Pharmacy of Tirgu Mures, after an informed consent was signed by the patients.

For the statistical analysis data were entered into Microsoft Office Excel and for inferential statistics the GraphPrism soft has been used. Kolmogorov-Smirnov test was used to asses the normal distribution of data. The applied statistical test was Anova for establishing the statistically significant difference for normally distributed continous variables. Kruskall Wallis test was used for variables with a non gaussian distribution. In both cases we applied Tukey test as post hoc test. We considered statistically significant if $p<\alpha=0.05$.

Results

The average age in our sample was 30±5 years old, the lowest being encountered in Romani pregnant women (22±4.33 years). The repartition based on ethnicity showed that our group included 64.07% Romanian women, 30.50% Hungarian women while the Romani women were in a percentage of 5.41%. In the Romani population it has been observed a lower average weight gain during pregnancy, compared with the other two ethnic groups (13.22 ± 5.192 kg compared with 15.76 ± 5.606 kg for Romanian and 14.37 ± 4.526 for Hungarian ethnic groups) but without exceeding the optimal weight gain minimal limit (Table 1).

By evaluating lifestyle behavioral factors during pregnancy, a significantly increased consumption of tobacco and alcohol was observed in the Romani women group, compared to the Romanian and Hungarian ethnic groups ($p<0.0032$ and $p<0.0169$).

The level of education was significantly lower for 92.7% of the Romani women ($p<0.0001$). None of the Romani women had a university degree, while 58.0% of Romanian women and 47.30% of the Hungarian women had a University degree.

Table 1. Characteristics of pregnant women in relation to ethnicity

Maternal characteristics	**Romanian**	**Hungarian**	**Romani**	***p-value***
Age (years) [a]817, [b]389, [c]69	30±5	30±5	22±5	< 0.0001
Body Mass Index (kg/m^2) [a]811, [b]389, [c]69	22±4	22±4	22±4	0.6813
Total weight gain (kg) [a]774, [b]362, [c]60	15.76±5.606	14.37±4.526	13.22±5.192	< 0.0001
Length (cm) [a]811, [b]389, [c]69	164.8±6.129	163.6±6.870	160.5±7.654	< 0.0001
Tobacco (no / %) (use during pregnancy)	232 (28.4)	116 (29.8)	33 (47.8)	0.0032
Coffee (no / %) (>2 cups per day during pregnancy)	63 (7.7)	33 (8.5)	6 (8.7)	0.8775
Alcohol use (no / %)	24 (2.9)	9 (2.3)	6 (8.7)	0.0169
Beverages (soda type) with sugar and CO_2 [a]727, [b]341, [c]60	213 (29.29)	60 (17.59)	15 (25.00)	0.0002
Water and liquids [a]219, [b]63, [c]6	108 (49.3)	30 (47.6)	6 (100)	N/A
Not cooking at home [a]808, [b]383, [c]66	9 (1.1)	0 (0)	0 (0)	N/A
Education				
≤8 classes (no / %) (+professional schools)	134 (16.4)	98 (25.2)	64 (92.7)	< 0.0001
High school (no / %)	209 (25.6)	107 (27.5)	5 (7.2)	0.0015
University school (no / %)	474 (58.0)	184 (47.3)	0	N/A
Without information regarding proper diet from health care providers [a]805, [b]389, [c]66	452 (56.1)	220 (56.5)	57 (86.3)	< 0.0001
Social income [a]703, [b]356, [c]60				
Low (no / %) (<70 and 70-110 Euro)	162 (23.0)	102 (28.6)	51 (85.0)	< 0.0001
Moderate (no / %) (330-1100 Euro)	502 (71.4)	248 (69.7)	9 (15.0)	< 0.0001
High (no / %) (>1100Euro)	39 (5.6)	6 (1.7)	0	N/A

[a]= the number of Romanian woman; [b]= the number of Hungarian woman; [c]= the number of Romani woman; N/A= not applicable

Also, statistically significant differences regarding familial monthly incomes were observed, with the lowest levels at Romani ethnic group (85%), compared to the other two groups (Table 1).

After analyzing the dietary behavior during pregnancy for the three ethnic groups, we observed the following: a deficient intake of dairy products was found in the Romani women (69.50%), of red meat in Romanians (23.20%), of white meat in Hungarians (83.40%) and Romanians (77.50%), of fish and eggs in Romani (99.30%) and Hungarian women (89.6%), of vegetables in Hungarian (93.80%) and the Romani (91.30%) women and of whole grain cereals in Romanian (93.40%) and Hungarian (95.50%) women. A water intake below the daily needs was found in 49.30% of Romanians, 47.60% of Hungarians and 100% of Romani women, respectively (Table 2). Following food excesses, differentiated on groups, it has been noticed an increased red meat and processed foods consumption by the Romani women ($p<0.0001$), a high intake of processed meat products by the Romani and Hungarian ethnic groups ($p<0.0001$), and sweet foods, chips, fries and pasta excesses in the Romani pregnant women group ($p<0.0001$). Fats' consumption was higher in the Hungarian ethnic group ($p<0.0001$), while carbonated drinks were consumed in higher amounts by the Romanian and Romani groups, compared to the Hungarian ethnic group.

The fewest information regarding optimal dietary behavior during pregnancy, as much as the physicians are concerned, were observed in the Romani ethnic group, significantly different to the Romanian and Hungarian groups ($p<0.0001$) (Table 2).

After analyzing the newborn characteristics, it has been found that weight for age score at birth was significantly lower, especially in Romani boys ($p<0.0328$).

Table 2. Diet pattern in relation to ethnicity

Poor Diet Pattern no (%)	**Romanian no (%)**	**Hungarian no (%)**	**Romani no (%)**	**p-value**
Diaries [a]775, [b]386, [c]69	311 (40.1)	127 (33.0)	48 (69.5)	< 0.0001
Red Meat [a]775, [b]380, [c]69	180 (23.2)	66 (17.4)	9 (13.0)	0.0184
White Meat [a]775, [b]380, [c]69	601 (77.5)	317 (83.4)	48 (69.5)	0.0104
Fish and Eggs [a]763, [b]386, [c]69	623 (81.6)	346 (89.6)	63 (91.3)	0.0005
Fats [a]769, [b]386, [c]69	111 (14.4)	60 (15.5)	12 (17.4)	0.7440
Fresh Fruits [a]778, [b]386, [c]66	757 (97.3)	383 (99.2)	66 (100)	N/A
Fresh Vegetables [a]769, [b]383, [c]69	760 (98.8)	383 (100)	69 (100)	N/A
Legumes [a]772, [b]386, [c]69	667 (86.4)	362 (93.8)	63 (91.3)	0.0006
Nuts and Seeds [a]769, [b]383, [c]69	492 (63.9)	222 (57.9)	39 (56.5)	0.0937
Pasta [a]727, [b]341, [c]60	407 (55.9)	235 (68.9)	45 (75)	< 0.0001
Total cereals and bread [a]640, [b]293,[c]48	598 (93.4)	281 (95.5)	33 (68.7)	< 0.0001
Excess Diet Pattern no (%)				
Red Meat [a]775, [b]380, [c]69	75 (10.33)	21 (5.52)	15 (21.73)	< 0.0001
White Meat [a]769, [b]386, [c]69	21 (2.73)	6 (1.55)	3 (4.34)	0.2742
Canned foods [a]763, [b]386, [c]69	110 (14.41)	79 (20.46)	18 (26.08)	0.0042
Processed Meat [a]769, [b]386, [c]69	288 (34.45)	234 (60.62)	48 (69.56)	< 0.0001
Sweets [a]772, [b]386, [c]69	539 (69.81)	235 (60.88)	60 (86.95)	< 0.0001
Chips and fried potatoes [a]769, [b]386, [c]69	168 (21.84)	78 (20.20)	51 (73.91)	< 0.0001
Fast Food [a]763, [b]386, [c]69	69 (9.04)	21 (5.75)	3 (4.34)	0.0540
Fats [a]763, [b]386, [c]69	51 (6.68)	69 (17.87)	6 (8.69)	< 0.0001
Pickles [a]775, [b]386, [c]69	122 (15.74)	76 (19.68)	12 (12.39)	0.2416
Pasta [a]769, [b]383, [c]69	51 (6.63)	18 (4.69)	15 (21.73)	< 0.0001

[a]= the number of Romanian woman; [b]= the number of Hungarian woman; [c]= the number of Romani woman; N/A= not applicable

Length for age score at birth was significantly lower (p<0.0001) in Romani and Romanian newborns, com-pared to the Hungarian newborns, both for girls and boys. Weight for length score of newborns did not show differences regarding ethnic groups but 1.14% of Hungarian boys and 0.87% Romanian girls had a too low weight at birth. Premature delivery has been noticed with a higher frequency in the Romani group, compared to the Romanians and Hungarians (p<0.0013) (Table 3).

Discussion

In 2015, in Southern USA, a study similar to ours, enrolling a women population of different races (Americans, Europeans, Africans), has been published by Colón-Ramos U et al, showing a direct correlation between different types of diets during pregnancy with the dimensions of newborns at birth. They also recommended the continuation of their research with a more complex study which should follow the nutrients composition of the foods consumed by the pregnant women, along with the analysis of both socio-ecologic and genetic aspects for every racial type (20).

An important study, carried out in Hungary by Balasz et al (21) on a sample of 9040 mothers, comparatively on those of Hungarian and Romani ethnicity, has associated the weight of newborns at term with socio-demographic aspects and biological data of the mothers. The results were similar to those obtained by us, the Romani newborns weighing on an average less than the non-Romani newborns (p<0.001, 95% CI=30.51-108.83). The mothers who had smoked during pregnancy had newborns with the highest weight difference at birth (-327.3 g), followed by those with a reduced level of education (-296.4 g) and those of Romani ethnicity (-288.7 g). In 2016, Dolle IM et al (22) have published a review of 4368 scientific articles, represented by observational studies from which they took into consideration lifestyle, socio-economic factors, environmental factors and different factors related to pregnancy in pregnant women originating from countries with average and high incomes. They have concluded that young pregnant women who have a lower level of education or do not follow general health advices seem to have a higher risk for an inadequate food intake. Also, they established that a thorough research methodology it is required for a better understanding of the interaction mechanisms between lifestyle related behavioral factors and dietary pattern in pregnancy.

Chia AR et al (23) have conducted in 2016 a study on a women population from Asia and identified three diet types practiced by women during pregnancy. First type of diet it is based on vegetables, fruits, white rice and it was associated with a reduced incidence of both premature delivery (7.60%) and reduced newborn dimensions at birth (13.40%) while regarding the other two diet types, in which sea fruits, pasta, dairy products and processed meat were more prominent, no correlations have been found with the birth results. In 2016 a transversal study (24) has been conducted in the Northern Ghana searching for possible correlations between the alimentation during pregnancy and dimensions of newborns at term. From the obtained

Table 3. Newborns characteristics in relation to ethnicity

Newborns characteristics	Romanian	Hungarian	Romani	p-value
Weight for Length score Boys [a]237, [b]105	0.07 (1.1)	-0.19 (1.14)	0	0.0491
Weight for Length score Girls [a]268, [b]118	-0.07 (0.87)	0.13 (0.85)	0	0.0326
Weight for Age score Boys [a]361, [b]157, [c]34	0.11 (1.0)	0.17 (0.92)	-0.37 (0.9)	0.0328
Weight for Age score Girls [a]409, [b]200, [c]27	-0.06 (1.03)	-0.03 (0.91)	0.03 (1.1)	0.8337
Length for Age score Boys [a]354, [b]158, [c]70	-0.04 (0.92)	0.08 (1.25)	-0.51 (0.95)	< 0.0001
Length for Age score Girls [a]383, [b]232, [c]54	-0.15 (0.87)	0.07 (1.11)	-0.36 (0.8)	< 0.0001
Apgar score (Median, Range)	9 (2 - 10)	9 (3 - 10)	9 (5 - 10)	< 0.0001
Premature delivery (no / %) (<37 weeks gestational age)	76 (11.03)	61 (16.01)	28 (22.04)	0.0013

[a]= the number of Romanian woman; [b]= the number of Hungarian woman, [c]= the number of Romani woman

results there were identified two types of dietary patterns in pregnant women, one based on a healthy alimentation through a diverse diet (traditionally dishes from maize, rice, fruits, vegetables, meat, eggs, water) and an unhealthy one due to high consumption of sweets, carbonated drinks, energizing chocolate drinks, traditional sweetened drinks and ice cream. Compar-ing these two diet types it has been shown that the in-cidence of low-weight at birth newborns was reduced in the group of pregnant women that had a healthy diet ($p<0.001$).

Similar to data described in the literature (25-29), data from our region showed that reduced intake of animal proteins was seen in Romanian and Hungarian women, with the mention that, for the Romanian subjects, an appropriate intake of fish-derived proteins was noted. Fibers' deficit was identified in all three ethnic groups while an excess of red and processed meat was discovered in Romani and Hungarian groups. Water intake was suboptimal for all subjects, with an excess of carbonated drinks evidentiated in the Romanian and Romani groups. For the Romani women's newborns significantly smaller anthropometric values were identified, when compared with the newborns of the other ethnic groups.

Lifestyle education and information on the risks associated with unhealthy lifestyles are extremely important in general, also having an impact on women's behavior during pregnancy and Romania is making efforts in this regard. Adapting health education programs to ethnic minorities' particularities should be included in the strategy of prevention and management of risk factors during pregnancy.

The study should be continued by enrolling a larger number of subjects to increase the strength of the results and to get new information on behavior during pregnancy.

Conclusions

In the context of the analyzed factors in our study, the Romani pregnant women presented a deficient diet and an inappropriate lifestyle for pregnancy, while between the Romanian pregnant women, representatives of the majority population, and Hungarian pregnant women no significant differences were noted. The prevalence of small-weight newborns from mothers with a balanced dietary behavior was reduced. Analyzing lifestyle socio-economical, educational and nutritional parameters, a group of Romani women who had newborns with a smaller birth weight and premature births was identified.

References

1. Bacârea A, Tarcea M, Boţianu PV, Ruţă F, Bacârea V, Age cut-off for type 2 diabetes mellitus screening amongst young adults from Mures District, Romania - A pilot study. Obes Res Clin Pract. 2015, 9(5):527-530.
2. Hanson MA, Bardsley A, De-Regil LA et al. The International Federation of Gynecology and Obstetrics (FIGO) rec-ommendations on adolescent, preconception, and maternal nutrition: "Think Nutrition First". Int J Gynaecol Obstet. 2015;131:S213–S253.
3. Wilkinson SA, Tolcher D. Nutrition and maternal health: what women want and can we provide it? Nutrition & Dietetics. 2010;67(1):18–25.
4. Dasinger JH, Alexander BT. Gender differences in developmental programming of cardiovascular diseases. Clinical Sci-ence. 2016;130(5):337–348.
5. Schoenaker DA, Mishra GD, Callaway LK, Soedamah-Muthu SS. The Role of Energy, Nutrients.Foods, and Dietary Patterns in the Development of Gestational Diabetes Mellitus: A Systematic Review of Observational Studies. Diabetes Care. 2016;39:16-23.
6. Heppe DH, Medina-Gomez C, Hofman A, Franco OH, Ri-vadeneira F, Jaddoe VW. Maternal first-trimester diet and childhood bone mass: the Generation R Study. Am J Clin Nutr. 2013;98(1):224-32.
7. Shin D, Lee KW, Song WO. Dietary Patterns during Pregnancy Are Associated with Risk of Gestational Diabetes Mellitus. Nutrients. 2015;7(11):9369-82.
8. Curtis E, Cheah J, Harvey NC. Prenatal Nutritional Influence on Skeletal Development. World Rev Nutr Diet. 2013;106:46–51.
9. McMillen C, MacLaughlin SM, Muhlhausler BS et al. Developmental origins of adult health and disease: the role of periconceptional and foetal nutrition. Basic Clin Pharmacol Toxicol. 2008;102:82–89.
10. Calkins K, Devaskar SU. Fetal origins of adult disease. Curr Probl Pediatr Adolesc Health Care. 2011;32(41):158–76. Leach L. Placental vascular dysfunction in diabetic pregnancies: intimations of fetal cardiovascular disease? Microcirculation. 2011;18(4):263–9.
11. Yajnik CS, Deshmukh US. Fetal programming: maternal nutrition and role of one-carbon metabolism. Rev Endocr Metab Disord. 2012;13:121–127.
12. Schrijvers JK, McNaughton SA, Beck KL, Kruger R.

Ex-ploring the Dietary Patterns of Young New Zealand Wom-en and Associations with BMI and Body Fat. Nutrients. 2016;8(8):E450.
13. Grieger JA, Grzeskowiak LE, Clifton VL. Preconception dietary patterns in human pregnancies are associated with preterm delivery. J Nutr. 2014;144(7):1075-1080.
14. Lu MS, Chen QZ, He JR et al. Maternal Dietary Patterns and Fetal Growth: A Large Prospective Cohort Study in China. Nutrients. 2016;8(5):E257.
15. Englund-Ogge L, Brantsaeter AL, Sengpiel V et al. Maternal dietary patterns and preterm delivery: Results from large prospective cohort study. BMJ 2014;348: g1446.
16. Okubo H, Miyake Y, Sasaki S et al. Maternal dietary patterns in pregnancy and fetal growth in Japan: The Osaka Maternal and Child Health Study. Br J Nutr. 2012;107:1526–33.
17. Oliveira A, de Lauzon-Guillain B, Jones L et al. Birth weight and eating behaviors of young children. J Pediatr. 2015;166(1):59-65.
18. Blumfield M, Hure A, MacDonald-Wicks L et al. The association between the macronutrient content of maternal diet and the adequacy of micronutrients during pregnancy in the Women and Their Children's Health (WATCH) study. Nutrients. 2012;4(12):1958-76.
19. Chiavarini M, Bartolucci F, Gili A, Pieroni L, Minelli L. Effects of individual and social factors on preterm birth and low birth weight: empirical evidence from regional data in Italy. Int J Public Health. 2012;57:261–268.
20. Colón-Ramos U, Racette SB, Ganiban J et al. Association between Dietary Patterns during Pregnancy and Birth Size Measures in a Diverse Population in Southern US. Nutrients. 2015;7:1318-1332.
21. Balázs P, Rákóczi I, Grenczer A, Foley K. Birth-weight differences of roma and non-roma neonates-Pubilc Health im-plications from a population-based study in Hungary. Cent Eur J Public Health. 2014;22(1):24–28.
22. Doyle IM, Borrmann B, Grosser A, Razum O, Spallek J. Determinants of dietary patterns and diet quality during pregnancy: a systematic review with narrative synthesis. Nutr. 2016;17:1-20.
23. Chia AR, de Seymour JV, Colega M et al. A vegetable, fruit, and white rice dietary pattern during pregnancy is associated with a lower risk of preterm birth and larger birth size in a multiethnic Asian cohort: the Growing Up in Singapore Towards healthy Outcomes (GUSTO) cohort study. Am J Clin Nutr. 2016;104(5):1416-1423.
24. Abubakari JA. Maternal Dietary Patterns and Practices and Birth Weight in Northern Ghana. PLoS One. 2016;11(9):e0162285.
25. Bartosovic I. Some aspects of health status of the Gypsy population in Slovakia. Public Health Nutr. 2016;18:1-9.
26. Brcanski J, Jović-Vraneš A, Marinković J, Favre D. Social determinants of malnutrition among Serbian children aged <5 years: ethnic and regional disparities. Int J Public Health. 2014;59(5):697-706.
27. Almeida NKO, Pedreira CE, Almeida RMVR. Impact of maternal education level on risk of low Apgar score. Public Health. 2016;140:244–2 49.
28. Araujo AM, Brandão SA, Araújo MA, Frota KM, Moreira-Araujo RS. Overweight and obesity in preschoolers: Prevalence and relation to food consumption. Rev Assoc Med Bras (1992). 2017 Feb;63(2):124-133.
29. Ruta F, Avram C, Voidazan S et al. Active smoking and associated behavioral risk factors before and during pregnancy –Prevalence and attitudes among newborns mothers in Mures county, Romania. European Journal of Public Health. 2016. 24(4), 276-280.

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