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CLINICAL STUDY

Different head morphology of full-term Gypsy and non-Gypsy newborns from Slovak Republic

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Abstract: *Background:* Early detection of cranial growth defects in childhood is extremely important for subsequent growth, development of head and could be a screening aid for early detection of growth deviations. Methods: Seven head dimensions and two indexes of 90 Gypsy and 99 non-Gypsy newborns from Slovakia were examined to asses the potential differences between the groups.
Results: Gypsy newborns had significantly lower head circumference, lower head length, lower width of head basis and facial width compared to non-Gypsy newborns. Gypsy newborns have shown significantly higher value of the index cephalicus while in non-Gypsy newborns mesocephalic values have been detected. Moreover, Gypsy newborns had significantly higher cranium as compared to non-Gypsy.
Conclusions: Gypsy subpopulation has a different head morphology compared to the majority of the population. Knowledge about the different head morphology between these ethnic groups could give us clues about the genetic influences determining head morphology in the prenatal development and therefore might be a helpful diagnostic tool in neonatology *(Tab. 1, Ref. 14).* Full Text (Free, PDF) *www.bmj.sk.*
Key words: cephalometry, head dimensions, Gypsy and non-Gypsy newborns.

Several specific characteristic morphological traits in form are demonstrated in the skull of neonate compared to the skull of an adult, such as large neurocranium and low splachnocranium. Diagnosis of growth defects in pediatric practice is strongly dependent on reference values of morphometric dimensions produced on the national level of the specific population (1). However, several different reference values of cranial dimensions can be present in the subpopulations within one nation as well as the influence of ethnicity on cranial morphology as has been described by Oliveira et al (2).

From the ethnic viewpoint, Gypsy belong to the Caucasoid population, their origins can be probably found in the central part of Western India. Gypsy (Gypsies) comprise the second largest ethnic minority in Slovakia. Their number in Slovakia is currently estimated to range from 480 to 520 thousands (total population in Slovakia is over 5 millions) and due to high birth rate, this number is permanently increasing. Problems of Gypsy minority in central Europe are often treated also in medical journals. However, up to 70 % of all published papers indexed in the database Medline come from Slovakia, Czech or Spain. The majority of papers point to bad health status of Gypsy compared to majority of the population (3). Gypsy subpopulation has a specific lifestyle, quite different from non-Gypsy population. The health status of Gypsy is much worse that the one of non-Gypsy population. Results of Szabova et al (4) point out the higher caloric intake in Gypsy inhabitants that is caused by high intake of fat and sugars, significantly increased incidence of obesity, low physical activity, higher incidence of nicotinism and alcoholism. Many anthropological studies are aimed at phenotypic manifestations of monogenic and polygenic heredity and indicate a different genetic constitution of Gypsy and non-Gypsy populations (5, 6). Moreover, Ferák et al (7) have reported the highest incidence of inbreeding in Slovak Gypsy population for the whole Europe.

The main goal of our research was to compare the values of basic and less common head dimensions and indexes obtained by means of non-invasive cephalometric methods from full-term newborns from Gypsy and non-Gypsy populations. We suppose that in spite of several centuries of coexistence of Gypsy people with the native population in Slovakia, the marriages between both populations were not frequent. This should be reflected also in different head morphologies.

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Subjects and methods

Cephalometric examinations were performed in Neonatology Departments in hospitals from three different Slovak cities (Bratislava, Nové Zámky, Komárno) in the years 2002–2006. Only full-term newborns were included into the examined groups. Newborns were assigned to two groups according to their nationality – Gypsy newborns and non-Gypsy newborns. On the whole, 90 Gypsy (50 males, 40 females, ratio 1.25) and 99 non-Gypsy (50 males, 49 females, ratio 1.02) newborns were examined. To avoid a possible influence of the perinatal head moulding on the measurements, all anthropometric examinations were performed on the fifth day after the delivery.

7 head dimensions were monitored and 2 indexes calculated from these dimensions. Subsequently, longitudinal and latitudinal values were determined by means of metal cephalometer:

– Maximum head length – direct distance between the *glabella* (over the bridge of the nose, between the superciliary arches) and the extreme dorsal point on the skull, over the *protuberantia occipitalis externa – opisthocranion*.
– Maximum head width – direct distance between the left and right *euryon*, the most lateral points on the *os parietale*, eventually on *os temporale*.
– Width of the cranial basis – direct distance between the left and right points on the upper edge of tragus. Increase in this distance provides information about the development of cranial basis.
– *Distantia bizygomatica* – facial width is the direct measure between the right and left *zygion*, which is the most distant point on the *arcus zygomaticus.*

By means of the tape measure following parameters on newborn heads were examined:

– Head circumference – was measured through the glabella and opisthocranion. This parameter shows a close correlation with the brain size and can be used for diagnosing of intracranial expansion (8).
– Transversal arch of the head – it is a circular measure that passes over the points *tragion – vertex – tragion*. Its value reflects appropriately all growth anomalies of the skull.
– Sagittal arch of the head – passes over the median plane of cranial vault from the bridge of nose through the vertex to *protuberantia occipitalis externa*.

Following indexes were calculated from these measures:

– *Index cephalicus* – longitudinal-latitudinal head index calculated as head width times 100 divided by a value of head length. This index enables the classification of individuals according to head form to dolichocephalic, mesocephalic and brachycephalic.
– Cranium width and transversal cranial arch index – is calculated from the relationship of cranial basis width times 100 divided by transversal cranial arch. The higher is the value of this index, the lower is the cranial vault.

An informed consent from all mothers of the investigated newborns was obtained.

Tab. 1. Head dimensions and indexes of Gypsy and non-Gypsy full-term newborns from Slovak Republic.

	Gypsy newborns Mean±SD	non-Gypsy newborns Mean±SD	p-value
Head circumference	33.28±1.27	34.29±1.13	<0.001*
Head lenght	11.52±0.64	11.73±0.56	0.028*
Head width	9.31±0.33	9.23±0.40	0.153 (NS)
Skull base width	7.77±0.48	8.42±0.41	<0.001*
Bizygomatic width of face	6.81±0.62	7.04±0.54	<0.001*
Transversal arch of head	21.82±1.15	20.23±2.45	<0.001*
Sagittal arch of head	22.24±1.17	19.97±1.27	<0.001*
Index cephalicus	81.05±4.16	78.83±4.09	<0.001*
Index of skull base width to transversal arch of head	35.67±2.38	41.42±3.85	<0.001*

SD – standard deviation, p – level of significance, NS – non-significant, * – significant

The values of head parameters and indexes were sorted in two groups according to the ethnical origin. For each parameter, the mean value and standard deviation have been calculated. Statistical evaluation was performed using statistical software SPSS for Windows version 13.0. Analysis was directed on testing the difference between two groups using the method of Mann-Whitney non-parametric test on the level of significance 95 % ($p<0.05$).

Results

Our results suggest that dimensions and indexes of heads of Gypsy newborns differ markedly from those of major population (Tab. 1). Gypsy newborns have significantly lower head circumference, smaller head length, as well as the width of cranial base and facial width. On the other hand, their values of transversal and sagittal cranial vault are significantly higher. Differences were found also in all examined indexes. The value of index cephalicus suggests that Gypsy newborns have brachycephalic heads, while non-Gypsy newborns have mesocephalic heads. By means of cranial width and transversal cranial arch index it was shown that Gypsy newborns have significantly higher cranium as compared to non-Gypsy newborns.

Discussion and conclusions

Gypsy population differs from the majority population in Slovakia not just in the way-of-life, but also in lower socio-economic-hygienic quality of life (9), higher cardiovascular risk (10, 11) as well as different distribution of blood group antigens (12), red cell enzymes (6) and overall other genetic profile (5). Gypsy newborns differ from non-Gypsy newborns in lower birth weight and birth body length (13). Bernasovský et al (14) have even suggested a special lower limit (2250 grams) for low birth weight classification of Gypsy newborns. However, this special limit is not used in practice due to unclear etiology of this difference in birth weight.

In our work we have proven different morphology of heads of Gypsy newborns compared to non-Gypsy newborns in

Slovakia. Gypsy newborns have significantly smaller head dimensions. It is interesting that while Gypsy newborns have brachycephalic heads, a debrachycephalization trend is apparent in non-Gypsy children. Similar trend was reported also in the neighboring Czech Republic (1).

Our results confirmed the importance of elaboration of directions for body measures not only on national level, but even for individual subpopulations. Similar conclusion has been reached also by Oliveira et al (2) in their examination of head measures in different populations within Brazil. Elaboration of detailed norms for head measures can help in early diagnostics of abnormalities in cranial growth and development in infants. Knowledge about differences in head morphology between individual ethnic groups can give us clues about the genetic effects in the determination of cranial morphology during prenatal development.

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