Impact of socio-economic status on malocclusions prevalence to school-children from Western Romania; ethnical disparities

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Abstract. Background: Epidemiological studies have demonstrated that the prevalence and the severity of malocclusion have increased over the years as well as the fact that children of lower socioeconomic background had more severe malocclusions and poorer general dental health. With respect to Western Romania, particularly to rural and small urban areas, isolated if considering the availability of pediatric dentistry services, facing increased unemployment and very low living standards, the information on oro-dental status on children, therewith the malocclusions epidemiology are scarce or missing. The mining area of Roșia Montană, Western Romania, is presenting the features as described above. Objectives: The aim of this study is an exhaustive approach of children population from Roșia Montană mining area, as to establish the prevalence of malocclusion as well as to determine the extent of socio-demographics features, such as ethnicity and socio-economic status may influence the malocclusion distribution. Material and method: In this cross-sectional study we investigated, within the study area, all the children who met the inclusion criteria. The batch consisted of 960 children (518 boys and 442 girls), aging 7 to 14. This batch represented 57.54% of total age category. There were two dimensions of the study: firstly, to establish the distribution of the batch by demographic factors and to determine the prevalence of malocclusions within the batch by Angle classes' distribution and secondly, the batch was investigated by the distribution of parental education level and family income level and we aimed to establish the correlations (if any) amongst the prevalence of malocclusions and education and income level, as to determine whether the socio-economic status could be considered as determinant in increasing prevalence of malocclusions. Results: Within the studied batch we determined a prevalence of malocclusions of 91.35%, wich is one of the highest prevalence in Europe. The malocclusion distribution varied significantly by parental level of education such as: the most affected category was „8 to 12 grades" category, standing for 93.1% malocclusion prevalence, as the least affected was paradoxically the „less than 4 grades" category, standing for 80.9% prevalence of malocclusion. The only possible explanation of this paradox could stand with the ethnical factor, as all the subjects who are part of „less than 4 grades" parental education category are Roma subjects. Likewise, weather the Romanian subjects followed a rule stating that the prevalence of malocclusion was inversely proportional to both level of education and level of income, in Roma subjects the distribution seemed not to follow such clear rules. Conclusions: The distribution of malocclusions depended on socio-economic status and ethnic variances. The prevalence of malocclusions in Roma subjects was significantly smaller than in Romanian subjects, despite the fact that Roma subjects were social and economical disadvantaged.

Key Words: malocclusion, prevalence, socio-economic status, ethnicity, Roma people.

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Introduction

Malocclusions are considered deviations from the normal evolution of dento-maxilary apparatus, being conditioned by a plurality of general and specific factors, presenting a varied ethiopatogenetic mechanism (Schapira 1973).

While considered nonlife threatening, malocclusion may cause altered functions (mastication, speech) and poor dento-facial esthetics that reduce the quality of life of affected subjects including social and functional limitations (Mtaya et al 2009).

Widespread and representing significant obstacles in social life integration, the malocclusions have become considerable public health issues, conducting to the necessity of determining the expansion within the population as well as the prevalence (Kenealy et al 1989).

Epidemiological studies have demonstrated that the prevalence and the severity of malocclusion have increased over the years as well as the fact that children of lower socioeconomic background had more severe malocclusions and poorer general dental health (Hebling et al 2004).

There are few if any exhaustive studies on oral health comprising significant number of children from a specific area of Romania whilst such a study may be essential in order to evaluate the health status of population as well as the tendencies in evolution (Dorobat et al 2011). Nevertheless, the few studies conducted on various groups of children from Romania show an increasing tendency in prevalence of malocclusions, varying from 50 to 60%, and 73.6% - 76.9%. Most of these studies

were conducted in large urban areas or adjacent to such areas in center and South-eastern part of the country.

With respect to Western Romania, particularly to rural and small urban areas, isolated if considering the availability of pediatric dentistry services, facing increased unemployment and very low living standards, the information on oro-dental status on children, therewith the malocclusions epidemiology, are scarce or missing.

The decline of living standards of population determined negative consequences in health. Consistent evidence suggests that people in lower socioeconomic position have a worse health and a worse oral health condition if compared with their counterparts in higher socioeconomic position (Ferda et al 2015).

Another particular feature of the study area is the ethnical diversity, as there is a significant presence of Roma population amongst children population (see table no.1). (http://www.recensamantromania.ro/rezultate-2/)

Table1. Romanians/Majority vs. Roma/Minority – Romania, Alba County, mining area and the studied batch

Region	Total population	Majority/ Romanians		Minority/Roma	
		Frequency	%	Frequency	%
Romania	20,121,641	16,792,868	83.4%	621,573	3.0%
Alba County	342,376	291,85	85.2%	14,292	4.1%
Studied area	11,347	10,267	90.4%	436	3.8%
The studied batch	960	836	87.0%	124	12.9%

The Roma are the most populous marginalized community in Europe and have some of the greatest health needs (Parekh et al 2011).

There are very few studies worldwide on Roma children health status, and we know little about their specific patterns of disease and how these differ from those of other groups (Martin 1997). Health policymakers and researchers have paid little attention to the health needs of Roma people, even though their distinctive way of life suggests these needs may be different from those of the majority population.

Roșia Montană mining area situated in Western Romania, Alba County, comprising of Roșia Montană and Bucium villages and Abrud town (9640 population in total, out of which 1716 children with ages varying from 0 to 15) was chosen as study area. Due to the scarce of available data in literature as regarding the comparison between prevalence of malocclusion in different mountain mining isolated areas, we investigated also the mining area of Baita, Bihor county, respectively the village of Baita and Nucet town (2165 population in total, out of which 354 children with ages varying from 0 to15 years old). Nucet is the second smallest town in Romania, established as a town back in the '50s as result of former USSR's intentions to investigate and exploit the uranium deposits existing nearby (few kilometers upstream Nucet) . Currently more than a half of 523 active population is working within the mental diseases facility existing in town (Olau et al 2012).

Relevant demographic data concerning the studied area publicly available as result of 2011 national population census (see table 2).(http://www.recensamantromania.ro/rezultate-2/).

Table 2. 2011 National Census results – studied area

Town/ village	Total population	Age group break down			Women	Men
		0-15	15-60	>60		
Abrud	5611	1086	3809	716	2802	2809
		19.3%	67.8%	12.7%	49.9%	50.0%
Bucium	1420	213	753	454	724	696
		15.0%	53.0%	32.0%	50.99%	49.0%
Roșia Montană	2609	417	1670	522	1312	1297
		16.0%	64.0%	20.0%	50.30%	49.7%
Nucet	2165	354	1358	453	1109	1056
		16.3%	62.7%	20.9%	51.2%	48.7

The aim of this study is an exhaustive approach of children population from Roșia Montană mining area, as to establish the prevalence of malocclusion as well as to determine the extent of socio-demographics features, such as ethnicity and socio-economic status may influence the malocclusion distribution.

Material and method

The current study has been completed during 2011-2013 and it is a cross-sectional study.

In order to complete the study, the formal approval of competent authorities has been obtained, as well as acceptance of schools management which were informed of the purpose and approah of the study. We visited all the schools from the study area, such as: five secondary schools from Roșia Montană village; one secondary school from Bucium; one secondary school and one high school from Abrud. With respect to Baita mining area, we visited the No. 1 Secondary School from Nucet, which hosted the children from both Baita village and Nucet town.

We investigated children with ages varying from 7 to 14 years old, presenting mixed dentition or early stages permanent dentition which is optimal stage of dental evolution to diagnose and implement proper treatments of malocclusions.

Within the study area all the children who met the inclusion criteria were investigated. Inclusion criteria were defined as follows: children aging 7-14, living within the mining area as defined above, living with bi-parental or mono-parental families, who had no orthodontic treatment and to whom the formal consent of parents was obtained. None of the subjects had a history of psychiatric problems or was physically or psychically disabled. The batch consisted of 960 children (518 boys and 442 girls), aging 7 to 14. This batch represented 57.54% of total age category, as stated by the 2011 census (1668 children aging 0 to 15) (see table 3).

Children were studied using the medical facilities available in each village (if available) or within the school classes made available by the school principles. Both school doctors and family doctors were helpful during the personal data and anamnestic data collection of each child. We put together all information in an individual evaluation file which contained all

Table 3. Study batch distribution by localities vs. the 2011 census data

Town/village	Subjects	Children aging 0-15	Representing % of batch	Representing % of total number of children (2011 census)
Roșia Montană	364	451	37.92%	80.75%
Abrud	433	720	45.10%	60.11%
Bucium	50	144	5.21%	34.84%
Nucet	113	354	11.77%	31.94%
Total subjects	960	1668		57.54%

relevant data on each subject: personal data, anamnestic data and data resulted from clinical examination.

The complete data of subjects were registered with the written consent of children's parents regarding the use of data in scientific and didactic purpose. The Ethic Committee established within the University of Oradea endorsed the parameters of the study. The approach of human sample was done facing two directions, clinical and scientific. The clinical examination was done in respect with OHS recommendation (WHO 1997). There were done neither dental radiography examinations nor dental casts, the orthodontic diagnosis being done based on clinical signs as revealed during physical examination of dento-maxilary apparatus. In order to establish the orthodontic diagnosis it was used the Angle classification of maloclusions, based on sagittal molar occlusion, such as:

- Angle I Class occlusion was considered the occlusion with following features: neutral relation at 6 years old molar, the anomaly being present at incisors level. By neutral relation we understand the situation when the mesiobuccal cusp of the maxillary first permanent molar occluded in line with mesiobuccal groove of the mandibular first permanent molar.

- Angle Class II/1 was considered the occlusion with following features: distalization relation at 6 years old molar, overjet exceeding 2 mm. By distalization relation we understand the the situation when there was deviation of at least one half cusp width distally to class I. Overjet was measured using a scaled dental probe such as: it was measured the distance between oral face of central superior incisors and buccal face of central lower incisors.

- Angle Class II/2 summoned up the following clinical signs: distalization relation of 6 years old molar and circumscription relation at incisors level.

- Angle Class III was considered for the following situations: mezialization relation at 6 years old molar presenting or not the negative overjet at incisors level. Mezialization relation is considered when there was deviation of at least one half cusp widths mesial to class I.

There were considered optimal occlusal relations the following features: at molar level: neutral relation; at incisor level: circumscription of lower incisors by upper incisors or overjet smaller than 2 mm; correspondence between the lower inter-incisor line and upper inter-incisor line; maximum 1/3 overbite (Cocârlă 2000).

Children presenting the occlusal relations as defined above were considered lacking malocclusions.

Moreover, children's parents were invited to fill in a questionnaire regarding their level of education and level of income as to establish the socio-economic status of subjects' families. The parental level of education was ranked considering 4 education

categories as follows: up to 4 grades (primary school), 4 to 8 grades (secondary school), 8 to 12 grades (high school) and over 12 grades (any form of post high school forms of education). The levels of education of both parents were recorded and it was considered the parent with the highest education when completing the final records of subjects.

There was also considered the monthly income level of subject's family. There were established 4 income level categories such as: lower than RON 500 monthly (EUR 111.49 considering the National Bank of Romania exchange rate as of Dec 31st, 2013) (http://www.cursbnr.ro/arhiva-curs-bnr-2013-12-31); RON 500 to 900 monthly (EUR 111.49 to 200.68); RON 900 to 1600 monthly (EUR 200.68 to 356.76), over RON 1600 monthly (over EUR 356.76).

The clinical and statistic studies were conducted by applying the variables of clinical diagnosis on the data base. The data assessment and interpretation of results was concluded using the features of statistical analysis (9.4.2.0 MedCalc). The subgroups of the batch were quantified as categorical variables (gender, environment of origin, locality, ethnicity and anomaly). The categorical variables with values exceeding 20 were assessed using Chi-square test. We established correlations between various factors and we assessed the statistical significance of results. By applying Chi-square test we discussed then the parameters of main interest by computing the P value, which represents the level of significance of test results; then the computed P values were compared with 0.05. The result is statistical significant for p computed < 0.05.

Results

The distribution of the batch by gender, age groups, environment of origin and ethnicity was described in a previous study (Todor et al 2014).

The batch distribution by ethnicity revealed 2 ethnical populations: majority or Romanians and minority or Roma population; majority population stood for 87.08% as the minority population stood for 12.92% within the batch. Whilst majority population is overcoming the minority by almost 8 times, the presence of Roma population within the batch is highly significant if compared with presence of Roma population in county and in Romania, as per 2011 census (table 1).

We established a prevalence of malocclusions of 91.35% within the batch. The chi-square test revealed significant statistical variances between the malocclusion group and the group of subjects without malocclusion, as such the value of p was smaller than 0.0001.

If considering the Angle Classes' prevalence within the studied batch, the Angle Class I was the most represented with 495
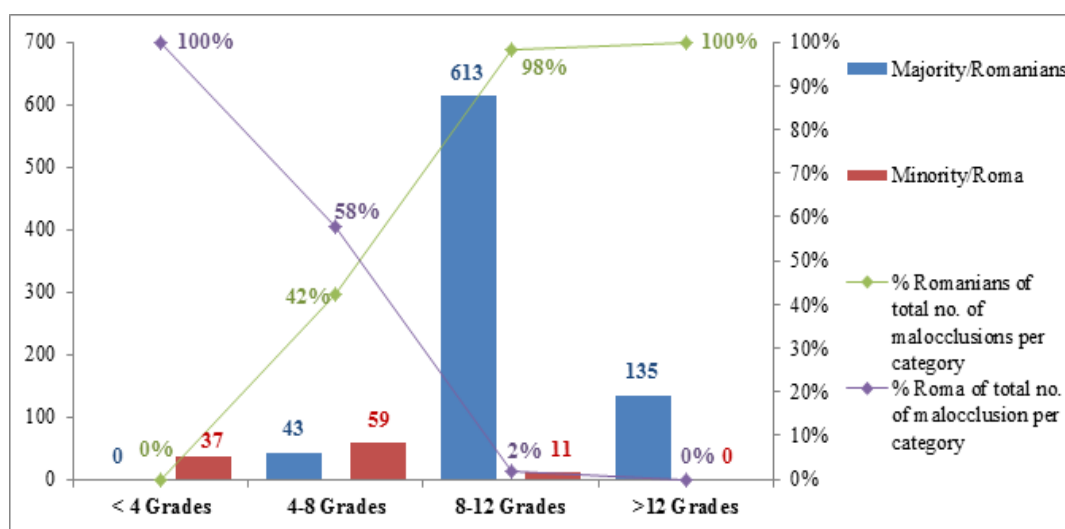
Figure no. 1: Distribution of malocclusions by parental level of education and ethnicity

subjects (standing for 51.5%), followed by Angle Class II/1 with 205 subjects (21.3%), Angle Class II/2 Angle with 127 subjects (13,2%) and Angle Class III with 50 subjects (5,2%) (table 5).

Table 4. Statistical significance evaluation of batch by presence of malocclusion

Batch distribution by presence of malocclusions	Frequency	%
Presence of malocclusions	877	91.3%
No malocclusions	83	8.6%
Chi-square test result	655.051	
Statistical significance	p<0.001	

Table 5. Distribution of malocclusions by Angle classes

Denomination of malocclusion	No. of measured malocclusions	% of whole batch
Angle Class I	495	51,50%
Angle Class II/1	205	21,30%
Angle Class II/2	127	13,20%
Angle Class III	50	5,20%

The distribution of the batch by parental level of education and family income was detailed in a previous study. If considering the parental level of education, most of the subjects were part of "8 to 12 grades" category – 68.40%, whilst "over 12 grades" category stood for 15.50% of the batch, "4 to 8 grades" category stood for 11.70% of the batch and the remaining 4.4% of the batch was represented by "less than 4 grades" category (many of these parents being illiterates). The statistical variances between the groups were reflected by p value of 0.001 (Todor et al 2014). The distribution of batch population by family level of income presented statistical significance as follows: the category "RON 500 to 900" was the largest (34.4% of the batch), followed by category "RON 900 to 1600" (33.7%), then category "over RON 900" which stood for 21.4% of batch and last the category "less than RON 500" which stood for 10.5% of batch (Todor et al 2014).

As such, Romanian subjects originated from highly educated families (76.7% of total Romanians, standing for 97.7% of whole "8 to 12 grades" category; whilst 17.8% of total Romanians stood for 100% of "over 12 grades" category); withal, Roma subjects originated predominantly from "4 to 8 grades" families (54% of whole Roma population, standing for 59.2% of category) and "less than 4 grades" category (33.8% of Roma subjects originated from this category, standing for 100% of the category). Regardless the ethnicity, the "8 to 12 grades" category is the largest (68.4% of total batch), followed by "over 12 grades" category with 15.5% of batch (Todor et al 2014).

In Romanian population (p=0.0183) the prevalence of malocclusions is decreasing by decreasing of parental level of education. Within the "4 to 8 grades" category just 5.4% of total Romanians population were registered with this category, developing 97.7% prevalence of malocclusion; within the "8 to 12 grades" category, there were 76.8% of total Romanians standing for 93.7% prevalence of malocclusion, whilst within "over 12 grades" category 17.8 were Romanians (100% of total category), and standing for 87.9% prevalence of malocclusion. In Roma population (total population of 124 subjects, p=0.32), the lowest education categories ("less than 4", respectively "4 to 8") stood for similar prevalence of malocclusion (80.9% and 83.5%), whilst the prevalence significantly decreased in subjects from "8 to 12 grades" category (66.6%). The "less than 4 grades" category stood for 33.9% of total Roma population; "4 to 8 grades" for 54% whilst "8 to12 grades" stood for 12.1% of total Roma population (figure 1).

There are significant statistical variances with regard to ethnical distribution by level of income (table 6).

Consequently, Roma subjects were almost exclusively gathered within low income categories ("less than RON 500" and "RON 500 to 900" – 74.2%, respectively 13.7% of total category of income); thus Romanians were gathered within upper level categories ("RON 500 to 900", 86.3% of total category, "RON 900 to 1600", 98.7% of total category and "more than RON 1600", 100% of total category).

Distribution of malocclusions by level of income was statistically significant. 95.1% was the prevalence of malocclusions for "RON 500 to 900" (this group standing for 34.4% of whole batch); 91.6% for "RON 900 to 1600" category (standing for 33.7% of whole batch); 89.2% for "over RON 1600" (standing
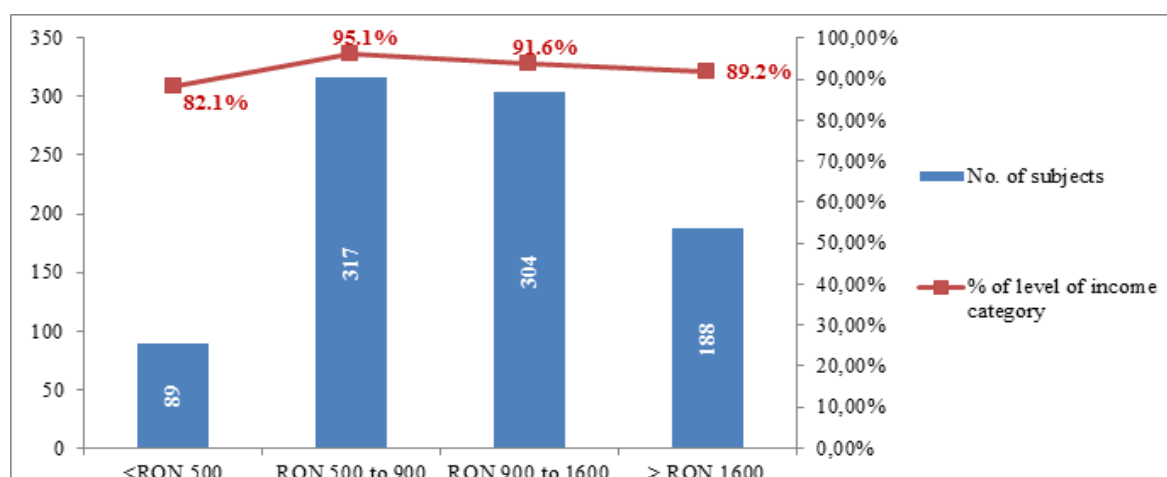
Figure 2. Distribution of malocclusions by level of income
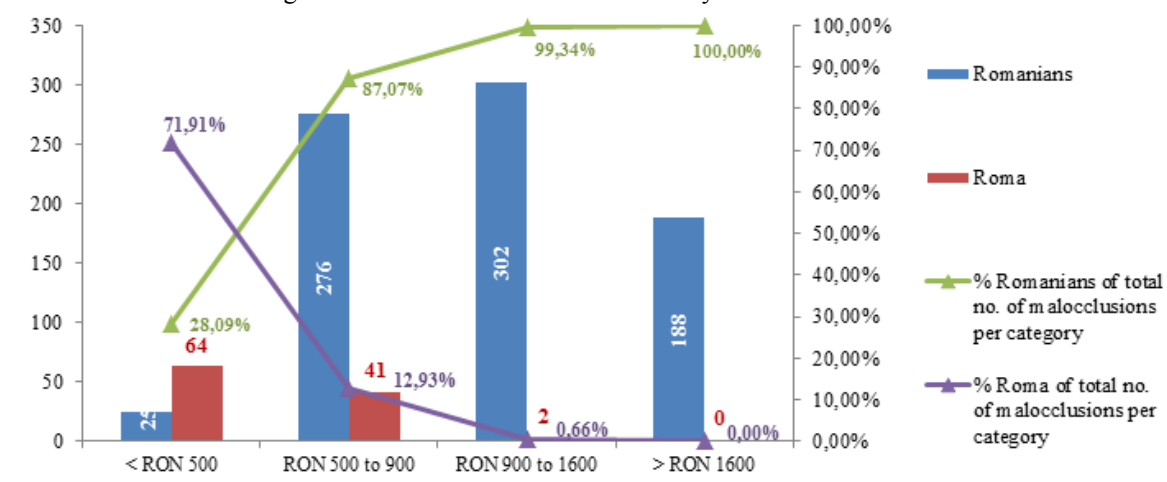

Figure 3. Distribution of malocclusions by level of income and ethnicity

for 21.4% of whole batch) and 82.1% for "less than RON 500" (for a population standing for 10.5% of whole batch) (figure 2).

Table 6. Statistical significance of ethnical distribution by level of income

Ethnicity distribution by level of income			
Level of income	**Ethnicity**		
	Romanians	**Roma**	
<RON 500	26	75	101 (10.5%)
RON 500 to 900	285	45	330 (34.4%)
RON 901 to 1600	320	4	324 (33.7%)
>RON 1600	205	0	205 (21.4%)
	836 (87.1%)	124 (12.9)	960 (100%)
Chi square test results	407.7		
Statistical significance	p<0.001		

The "less than RON 500" category stood for 3.1% of Romanians with a prevalence of malocclusions of 96.1% of whole category. Similar percentage values were obtained for "RON 500 to 900", but for different number of subjects (34.1% of Romanians). Once the income became higher ("RON 900 to 1600" category) the

prevalence of malocclusions decreased to 92.1% (this sub-category stood for 38.3% of Romanians). Finally, the "over RON 1600" category stood for a prevalence of 89.2% of malocclusions (24.5% of Romanians).

In Roma population (p=0.08, significant statistical variances) the prevalence of malocclusions did not appear to follow any rule; as such, the lowest prevalence value (50%) was found in highest level of income category (standing for 3.2% of Roma population), followed by the lowest level of income category (77.3%, standing for 60.5% of Roma population). The intermediate category ("RON 500 to 900") stood for 88.8% prevalence of malocclusion (representing 36.3% of whole Roma population). The Roma population within the batch measured 124 individuals of total of 960 subjects.

Discussions

Social epidemiology faced significant progresses the last years, when social discrepancies worsened in many countries. This situation forced the researchers to understand social discrepancies and their effects on health in order to improve the health status of population.

Within the studied batch we determined a prevalence of malocclusions of 91.35%. The researches conducted in Europe indicated a prevalence of malocclusion such as: 40% in Germany, 70.4% in Hungary, 78% in Norway, 84.71% in Lithuania (Sidlauskas et al 2009; Gábris et al 2006; Perinetti et al 2008).

The comparison with the above mentioned results ranked the population within the studied area as presenting one of the highest prevalence in Europe.

In Romania, the epidemiological studies revealed prevalence values ranging from 41.9% to 76.9%. Compared to data available in Romanian medical literature, the prevalence value of 91.3% measured within the batch was significantly higher.

The distribution results of prevalence of Angle Classes showed values in line with several references from Central Europe (Tomislav 2003; Bugaighis et al 2013; Sidlauskas et al 2009). Some researcher had found that malocclusion was more severe in preadolescent school children from lower socioeconomic background, indicating social disparities in oral health (Antoine et al 2015).

There were studies stating that individuals with precarious social and economic status as well as in poor mental condition due to poor living standards tend to negatively impact the way these individuals raise and educate their offspring.(Blackburn C. 1991) We intended to prove within the current study that socio-economic factors, together with the parental levels of education and income could be risk factors with regards to prevalence of malocclusion. In line with this, we proved that there are significant statistical variances amongst the four sub-categories of education, the category „8 to 12 grades" being mostly affected, which still stands for rather lower standard of education.

If considering the level of income per family, we established that the standard of living is rather poor as most of the subjects were part of „RON 500-900" / (EURO 111.49 to 200.68) per family. The parental level of education varied significantly between the two ethnicities (p< 0,0001), thus out of the total „8 to 12 grades" category, 97.7% were Romanians whilst the „over 12 grades" category is 100% covered by Romanians; in opposition with that, for „less than 4 grades" category, the Roma stood for 100%. Based on these facts we may say that Romanian subjects had a higher parental level of education than Roma subjects.

The malocclusion distribution varied significantly by parental level of education such as: the most affected category was „8 to 12 grades" category, standing for 93.1% malocclusion prevalence, as the least affected was paradoxically the „less than 4 grades" category, standing for 80.9% prevalence of malocclusion. The only possible explanation of this paradox could stand with the ethnical factor, as all the subjects who are part of „less than 4 grades" parental education category are Roma subjects.

When assessing the malocclusion distribution by parental education and ethnicity, we observed that if for Romanians the prevalence of malocclusions decreased by increasing of level of education, with values ranging from 97.7% in „4 to 8 grades" category to 87.9% in „over 12 grades" category (p=0.0183), in Roma population this tendency was not the same, as the highest levels of malocclusion (83.5%) stood with „4 to 8 grades", substantially equal to values measured for „under 4 grades" category (80.9%), whilst the value suffered a steep drop for „8 to 12 grades" category (66%).

There were measured significant statistical variances in parental income level distribution amongst the two ethnicities (p<0,001). Out of total income level of "less than RON 500", 72.45 were Roma subjects, whilst Romanians subjects were better balanced within the batch in terms of income distribution (for "over RON 1600" category representing 100% of the category).

Distribution of malocclusions by parental level of income registered significant statistical variances (p=0.004). The highest prevalence of malocclusion was measured in "RON 500 to 900" category, slightly decreasing for "over RON 1600" category (89.2%). Still the lowest malocclusion prevalence value was measured for the lowest income category level (82.1%, "less than RON 500" category). This fact could be explained by the fact that all the subjects in this category were Roma subjects. Although Roma children were socially and economically disadvantaged compared to Romanian children, as they were part of poorer and less educated families, they were measured significantly smaller values for malocclusion prevalence compared to Romanian children.

Likewise, weather the Romanian subjects followed a rule stating that the prevalence of malocclusion was inversely proportional to both level of education and level of income, in Roma children the distribution seemed to not follow such clear rules. We could not find any studies for comparing these results, so in this regard our study makes a unique contribution to the literature on malocclusion prevalence between Roma and non-Roma children.

Further research is needed to better explain weather the better values of malocclusion prevalence measured in Roma population may be due to the size of the sample or to the different pattern of genetic inheritance in terms of malocclusion to this ethnicity. We considered necessary to determine the prevalence of malocclusion in a larger Roma sample, considering also other classification as to better diagnose from a qualitative perspective the prevalence of malocclusions, as to determine the severity of these malocclusions in different ethnicity, as to be able to compare the ethnical influence on the results.

Conclusions

The prevalence of malocclusions in school children from studied deprived area turned very high results (91.3%) whilst the distribution of malocclusions depended on socio-economic status and ethnic variances.

The prevalence of malocclusions in Roma subjects was significantly smaller than in Romanian subjects, despite the fact that Roma subjects were socially and economically disadvantaged. There are required in depth studies with regard to specific patterns of oral diseases to Roma people, and to find in witch way those patterns differ from other groups.

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