THE INFLUENCE OF SOCIO-DEMOGRAPHIC FACTORS ON AGE AT MENARCHE IN NORTH BAČKA REGION (THE REPUBLIC OF SERBIA)

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Abstract

Objectives. Menarche occurrence is influenced by genetic and environmental or external factors. The influence of external factors that affect age at menarche vary in different populations.

Material and methods. Anthropological survey was carried out in primary and secondary schools in rural and urban places of North Bačka region in Vojvodina (North part of the Republic of Serbia). The investigation was performed between 2017-2020, and the data used in this study represents a part from this large comprehensive anthropological survey. The study included a total of 1971 adolescent girls aged from 7 to 18 years, out of whom 514 (26.08%) had menarche. The survey used the status quo method to collect individual data on menarche. The following socio-economic and demographic parameters were examined: parents' educational level, the number of children in the family, participation in sports activities outside of school, settlement size and nationality.

Results. The present study showed that the average menarcheal age was 12.23 ± 1.18 years and the median equals 12.22 years. No relationship was observed with regard to external factors. Only with regard to sports activities outside of school, statistical differences were found. The onset of menarche in girls who practice some sport was somewhat earlier than in girls without any additional physical activity.

Conclusions. The study shows that in the last few decades there has been a trend toward lowering of age at menarche in Serbian girls. It is also observed that differences in socio-economic conditions seem to be flattened between rural and urban places.

Keywords: adolescent girls, menarche, external factors.

Introduction

Menarche occurrence represents the onset of reproductive life and occurs as a result of a series of physiological and anatomical processes of puberty. Puberty leads to an increase of somatic growth and changes in body proportions. Beside biological factors, many different environmental/external factors may influence the timing and progression of puberty (Apter, 2002). According to Kaczmarek (2000) the average time interval between age at menarche and age at the peak of height velocity was 1.28 years. Girls experience menarche usually between the ages of 10 and 16 years, but the mean age of menarche varies significantly in different geographical regions (Kamarulzaman, Mohamed, & Ridzuan, 2019; Zeglen et al., 2019). The age at menarche in girls is reliable indicator of adolescents' health condition (Bodzsar & Zsaki, 2002), and can also affect the health of women in later life. Research has shown that early onset of menarche is one of the

important indicators for getting some diseases such as breast cancer (Bodicoat et al., 2014), ischemic heart disease (Cooper et al., 1990), and is associated with hypertension, diabetes, and metabolic syndrome (Won, Hong, Noh & Kim, 2016). Eiben and Mascie-Taylor (2003) distinguish two major groups of factors that influence menarche occurence, that is genetic and environmental factors, such as ecological and socio-economic conditions. A large number of studies demonstrated that menarcheal age is affected by nutritional status and physical activity (Papadimitriou et al., 2008; Anderson & Must 2005; Al-Awadhi et al., 2013), socio-economic status (Ersoy, Balkan, Gunay, Onag, & Egemen, 2004; Padez, 2007; Castilho, Pinheiro, Bento, Barros-Filho, & Cocetti, 2012), family structure (Veronesi & Gueresi, 1994), as well as the place of residence, i.e urban/rural environment (Szwed, John, Czapla, & Kosinska, 2013). Recent data based on 112 relevant studies on timing of menarche (Canelon & Boland, 2020) found that climate change events and increases in extreme weather events could perturb the natural timing of menarche either through increased release of toxins and pollutants buried in soil and water or by impacting food availability via crop failure. These research indicate that the climate does have the potential to impact timing of menarche and causally will affect women's future risk of disease. Previous studies on menarcheal age in girls from Vojvodina region included a number of rural (Gavrilović, 1991; Gavrilović & Božić-Krstić 1994; Gavrilović 2000) and urban places (Selaković & Gavrilović 1986; Kolarov, Cerni, & Jović, 2005). This study aimed to determine the influence of certain external ie. socio-demographic factors at the time of menarche in today's girls in North Bačka region of Vojvodina and to describe a possible secular trend in comparison with previous studies in Vojvodina.

Material and methods

Cross-sectional anthropological survey was carried out in primary and secondary schools in rural and urban places of North Bačka region in Vojvodina (North part of the Republic of Serbia). The investigation was performed between 2017-2020, and the data used in this study represents a part from this large comprehensive anthropological survey. The study included a total of 1971 adolescent girls aged from 7 to 18 years, out of whom 514 (26.08%) had menarche. In total the girls were investigated in 32 primary and 5 secondary schools. The survey used the status quo method to collect individual data on menarche, by asking girls in the appropriate age range whether or not they have reached menarche. The following socio-economic and demographic parameters were examined: parents' educational level, the number of children in the family, participation in sports activities outside of school, settlement size and nationality. Educational level of parents was based on the highest level completed by each respondent and was grouped into three categories: primary, secondary, higher/high education. Number of children in the family included three groups: 1-2, 3, 4 and more children. Physical activity involved engaging in some form of physical activity outside of school, and respondents were divided into two groups. YES I do some sports in my free time, NO I don't do some sports in my free time. With regard to settlement size respondents were grouped into four groups: <1000, 1000-10.000, 10.000-20.000, >100.000. To take into account the effect of urbanization, type of locality was categorized into rural and urban. With regards to ethnicity, the four most numerous ethnic groups were investigated: Serbs, Hungarians, Croats and Romas. Data were analyzed with SPSS software for Windows version SPSS Statistics version 21 (SPSS Incorporation, Chicago, USA). The data analysis included descriptive statistics for menarcheal age and linear univariate regression analysis to determine the relationship between age at menarche and socioeconomic and demographic factors. One-Way ANOVA was applied for comparisons of the mean age at menarche with others

investigations in Vojvodina. Bonferroni's multiple comparison tests was used to determine possible significant differences in the time of menarche. The overall significance level was set at P < 0.05. The research protocol was approved by the Provincial Secretariat for Education, Regulations, Administration and National Minorities – National Communities, Scientific Committee of the Department for Biology and Ecology, University of Novi Sad and primary and secondary school principles. Informed consent was obtained from participants and their parents before data collection and the inclusion of subjects was on voluntary basis.

Results

The results indicated (Table 1) that the parents of the examined girls have mostly secondary education (fathers 63.11%; mothers 56.88%). A slightly higher percentage of mothers had higher / high education (27.29%) compared to fathers (18.34%), while a lower percentage of parents of both sexes have completed only primary school (fathers 18.55%; mothers 15.83%). The largest number of girls grew up in a family with one or two children (72.95%), while the smallest number of girls comes from families with 4 or more children (6.76%). Almost half of the surveyed girls had some additional physical activity outside school (49.80%) and lived in settlements with over 100,000 inhabitants (51.22%). The girls were mostly of Serbian (60.37%) and Hungarian nationality (34.55%), while members of Croatian (3.25 %%) and Roma (1.83%) nationality were significantly less.

Table 1

Socio-economic and demographic parameters of the participants

Socio-economic and demographic factors		N	%
Education of father	Primary	87	18,55
	Secondary	296	63,11
	Higher	86	18,34
Education of mother	Primary	76	15,83
	Secondary	273	56,88
	Higher	131	27,29
Number of children in the family	1-2	356	72,95
	3	99	20,29
	4 or more	33	6,76
Sports activities outside of school	Yes	245	49,80
	No	247	50,20
Settlement size	< 1000	12	2,44
	1000-10000	201	40,85
	10000-20000	27	5,49
	>100000	252	51,22
Nationality	Serbs	297	60,37
	Hungarians	170	34,55
	Croats	16	3,25
	Roma	9	1,83

In the total sample of 1971 girls, 514 (26.08%) had menarche, and 1457 (73.92%) did not (Table 2). The exact date of menarche knows 95.72% of girls and the others 4.28% were not sure of the exact date, so these respondents were excluded from further analysis.

Table 2

The distribution of girls with and without menarche

	N	%
The total number of girls	1971	100
Menstruating	514	26.08
Non menstruating	1457	73.92
Knows the exact date of menarche	492	95.72
Doesn't know the exact date of menarche	22	4.28

The mean value of the menarcheal age was 12.23±1.18 years (Table 3). The earliest menarch appeared at the age of 8.61 years and the latest at the age of 16.53 years. The median and the mean values were approximately equal.

Table 3

Descriptive statistics for menarcheal age

Investigation period	2017-2020
Number	492
Mean	12.23
Standard deviation	1.18
Minimum	8.61
Maximum	16.53
Range	6.93
Coefficient of variance	0.09
Median	12.22

No relationship was observed with regard to external factors (Table 4). Only with regard to sports activities outside of school, we found more significant relationship. The onset of menarche in girls who practice some sport was somewhat earlier than in girls without any additional physical activity.

Table 4

Results of a Linear regression analysis of age at menarche on a set of predictor variables

	Beta	P-value
Education of father	-0.01	0.880
Education of mother	0.15	0.131

	Beta	P-value
Number of children in the family	0.02	0.780
Sports activities outside of school	-0.29	0.000[**]
Settlement size	-0.05	0.361
Nationality	-0.04	0.581

Discussion

The mean age at menarche in North Bačka region was 12.23 years which is lower than the overall menarcheal age (13.53 ± 0.98 years) recorded in 67 countries in 2001 (Must et al., 2002). If these results are compared with the results of previous surveys in Vojvodina (Table 5), a significant decrease in the average values of menarcheal age can be observed. In the period between 2001 to 2004 years (Rakić, 2009) in total, 2935 girls aged 11 to 18 years (10.50-18.49) were examined out of whom 2019 (68.8%) were with menarche. For the period from 2011 to 2014, the data from several surveys conducted in towns in Vojvodina (Vašaš, 2011; Đuriš, 2012; Herubel, 2013; Isak, 2014) were used and included a total of 1222 adolescents aged from 11 to 15 years (10.50-15.49), out of whom 683 (55.9%) had menarche.

Table 5

The mean age at menarche in Vojvodina in different time intervals

	2001-2004 [a]	2011-2014 [b]	2017-2020 [c]
Number	2019	683	492
Mean[&]	12.60[***]	12.38	12.23
Standard deviation	1.11	1.04	1.18
Minimum	8.55	9.38	8.61
Maximum	15.48	14.88	16.53
Range	6.93	5.50	7.92
Coefficient of variance	0.09	0.08	0.09
Median	12.62	12.50	12.22

[&]One-Way Anova (P<0.001); Means with different alphabet letters are significantly different by Bonferroni'smultiple comparison test a/b,c; [***] P<0.001

The results of these studies show that at the beginning of the first decades of the 21st century the mean age at menarche in Vojvodina was 12.60 (2001-2004) and 12.38 (2011-2014) which is higher than the values of today's girls (12.23). Standard deviation showed a decrease from 1.11 (2001-2004) to 1.04 (2011-2014), and then increased to 1.18 years (2017-2020). This may be explained by certain changes in external factors, i.e. improved diet and socio-economic conditions in one portion of the population. A systematic decrease in average values of menarcheal age can also be seen by comparing these data with results from more than 40 years ago (Gavrilović & Radojević 1978) when the median menarche of girls in Vojvodina was 12.84 ± 0.07 years. These data indicate a continuous downward secular trend of age at menarche and constant increase in developmental tempo. Mean age at menarche also showed a decline in Europe - Romania (Pop, Tenenboum, & Pop, 2021), Bulgaria (Tomova, Geno, Kumanov, & Robeva, 2009), Hungary

(Bodzsar, Zsakai, & Mascie Taylor, 2016), Portugal (Padez, 2007), as well as in other countries of the world- China (Song et al., 2015; Meng, Li, Duan, Sun, &, Jia, 2017), Mexico (Garduño, Catillo-López, Alcalá-Herrera, & Canal, 2016) and India (Ramraj, Subramanian, & Vijayakrishnan, 2021). Although research has been done in many countries the cause of the population-level reduction in age of menarche that has been observed in industrialized countries remains unknown (Canelon & Boland 2020).

The influence of sociodemographic factors in various investigations worldwide, shows the different magnitude of the relationship of these factors with the time of menarche (Canelon & Boland 2020). In this investigation, parents educational level, number of children in the family, settlement size and nationality didn't show a significant relationship with menarche. Only with regard to sports activities outside of school, more significant relationship was found. The onset of menarche in girls who practice some sport was somewhat earlier than in girls without any additional physical activity. Recent survey of Idris and his colleagues (2021) found that the proportion of girls who have attained earlier age of menarche was higher among daughters of highly educated and employed parents, though the difference was not significant. Szwed and his colleagues (2013) demonstrated that the girls from large families (four and more children) were the latest to cross the pubertal threshold on average at the age of 13.54 years. It was observed that school girls aged 10–12 years who were living in urban areas and girls in urban living with rich family got menarche earlier compare to rural girls. These results are not in agreement with findings of this investigation.

Yermachenk and Dvornyk, (2014) in their systematic review present worldwide research data on the relationship between sociodemographic factors and age at menarche. They state that in developing countries studies reported the association between socioeconomic status and age at menarche (Dambhare, Wagh, & Dudhe, 2012; Tunau et al., 2012). In upper-middle income countries the impact of socioeconomic status on age at menarche is still significant (Atay, Turan, Guran, Furman, & Bereket, 2011; Amigo, Vásquez, Bustos, Ortiz, & Lara, 2012). Better socioeconomic status led to a decrease in age at menarche of urban girls as compared to their rural counterparts. In developed countries socioeconomic factors do not play a significant role in the onset of puberty (Wronka, 2010; Rigon et al., 2010). The results of this investigation are in accordance with the data obtained in developed countries, because no significant association was found with any factor. The only factor that has shown a certain association with age at menarche is sports activities outside of school. The onset of menarche in girls who practice some sport was somewhat earlier than in girls without any additional physical activity. Earlier investigations has shown that one of social causes of early menarche include lack of physical activity in girls (Malina, 1983). Another study found that swimmers, track athletes and rowers were no different to controls with regards to age at menarche, and specific sports appear to result in typical age of menarche (Malina, 1994). It is well documented delay age at menarche for adolescent girls exposed to regular high intensive physical exercise in childhood and adolescence (Roupas & Georgopoulos, 2011). Study in Korea (Lee, Pabayo, & Kawachi, 2016) reported conflicting results, with early and late menarche observed among girls participating in physical activity and normal menarche observed for those with sedentary activity. The authors suggest that it is possible that the specific type of physical activity could affect timing of menarche, but likely not physical exercise in general given the conflicting results.

Conclusions

The study shows that in the last few decades there has been a trend toward lowering of age at menarche in girls from this part of the region in Serbia. No relationship is observed with regard to external factors. Additional sports activities outside of school proved to be the only factor influencing a somewhat earlier occurrence of menarche. Relationship of sociodemographic parameters with age at menarche corresponds to the association established in developed countries and may indicate that differences in socio-economic conditions seem to be flattened between rural and urban places. However, similar research in other regions of Serbia would certainly contribute to better understanding the magnitude of association between these factors and age at menarche.

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