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SELECTED ASPECTS OF HEALTH STATUS IN RURAL AND URBAN YOUNG SLOVAK WOMEN

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Abstract

The menarche is a milestone in a woman's life, when she enters her fertility period, the period when she can lay the foundations of a new life. However, many researchers are concerned with the impact of regular and intensive sport performance on menarcheal age as research has found that age at menarche is statistically significantly related to BMI, and a relationship between overweight (BMI > 25 kg /m2) and earlier onset of menarche has been identified. This study presents the results based on data obtained from a sample of 411 young Slovak female students aged 18.80 ± 1.87 years. We assessed the age at menarche in the current Slovak population in relation to their place of residence (urban or rural), and the amount of their sport activity before menarche. The mean menarcheal age of girls who performed intensive sport activities before menarche was 13.296 ± 0.87 years (urban girls 13.359 ± 0.75, rural girls 13.227 ± 0.99). The mean menarcheal age of girls who did not do sports on a regular basis was 12.792 ± 0.81 years (urban girls 12.818 ± 0.84, rural girls 12.774 ± 0.79). The analysis proved that the age at menarche to be significantly affected by sport activities. No significant differences were recorded between urban and rural girls as far as the smoking habit is concerned. Our results confirm that the factor of intensive sport performance has a statistically significant impact on age at menarche, and performing regular intensive sport activities delays the onset of menarche.

Keywords: Health-related rural-urban divide, obesity, underweight, menarche, smoking, gynaecologist appointments.

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1. Introduction

The first occurrence of menstruation is an important landmark in a woman's reproductive life. It is a sudden, accurately defined biological event (Golub, 1992). A menarche is not only a notion referring to the first occurrence of menstruation in girls; it is also a milestone in a woman's life, when she enters her fertility period, the period when she can lay the foundations of a new life. The age at menarche reveals a lot of information about the researched population, about their living standards, state of nutrition, level of hygiene, geographical and social environment, etc. As proposed by several authors (Milicer, 1968; Tanner, 1973; Lindgren, 1973; Ersoy et al, 2004) age at menarche is characterized by high eco-sensitivity, and, thus, it can serve as a biological indicator of living standards of the society. The age at the first occurrence of menstruation is often used as indicator of pubertal maturation of girls; it has a genetic basis, and at the same time it is affected by the environment (Ersoy et al, 2004; Gomula & Koziel 2015). That is why the menarcheal age is considered to be one of the most characteristic signs of maturation in girls.

The variability of age at the first occurrence of menstruation is relatively high on a worldwide scale. It is influenced by genetic, geographical, climatic, ethnic and socioeconomic aspects; yet, globally there is one common trend: decreasing menarcheal age in girls (Taranger, 1983; Rimpelä & Rimpelä 1993; Chowdhury et al, 2000). The average age at menarche decreased from 16 years in women born around 1830 to 13 years in women born around 1960 (Brudevoll et al, 1979). The decreasing menarcheal age in developed countries is reported by researchers from all over the world. The average age at menarche decreased from 14 years at the beginning of the 20th century to approximately 12.8 years till 1940 (Zacharias, Wurtman 1969; Wyshak, Frisch 1982). At present the average menarcheal age is reported to assume values between 12 and 13 years in several countries (Parent et al, 2003; Deligeoroglou & Creatsas 2012). Nowadays the age at menarche is getting stabilised in socioeconomically stable conditions, and most European countries report the average menarcheal age to be 13 years. The variability of the average age at menarche is from 12 years (Greece) to 16.1 years (Senegal) according to values recorded in 66 countries (Thomas et al, 2001). Generally, the average menarcheal age lower than 13 years is recorded in Europe, Russia, China, Japan and in some American states, whereas in Africa and Asia it assumes higher values. This variability among countries is caused by various factors, the most frequently noted are environmental factors (climate, altitude, isolation etc.) (Barnes-Josiah & Augustin, 1995; Gonzales & Villena 1996).

The first menstruation is influenced by many factors, e. g. genetic predispositions, ethnic affiliation, climatic and geographic conditions, socioeconomic conditions, nutrition, physical activity/load, place of residence (urban or rural), state of health, family size, achieved education of parents and their occupation, body mass index (BMI), passive smoking etc. (Bielicki et al, 1986; Merzenich et al, 1993; Kimm et al, 2001; Ersoy et al, 2004; Matchock et al, 2004; Mollaei et al, 2006; Gaudineau et al, 2010; Ferris et al, 2010; Wiley, 2011; Wronka, 2010). In Hungarian society it was found that the timing of pubertal development in girls living in the seriously deprived regions showed a 1 - 3 month shift toward older ages (Bodszar & Zsakai 2015). In recent years several studies have reported that the decreasing tendency of age at menarche is related to the increasing number of childhood obesity cases in western industrial countries (Parent et al, 2003; Cabanes et al, 2009; Rigon et al, 2010).

Age at menarche is statistically significantly related to BMI, and a relationship between overweight (BMI > 25 kg /m2) and earlier onset of menarche has been identified (De Sanctis et al, 2014). According

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to some studies, the menarcheal age negatively correlates with BMI value in adulthood (Laitinen et al, 2001). Some scientists observed that earlier maturation of girls is related to abdominal fat accumulation (Frisancho & Flegel 1982). There are several explanations of this relation between a menarche onset and obesity, yet the specific mechanisms remain unclear. One of the explanations is that higher values of BMI in puberty lead to increased production and availability of oestrogen through various mechanisms, which leads to earlier menarche onset (Cheng et al, 2012). Another explanation indicates that earlier onset of menarche is associated with higher level of oestrogen, which increases a fat accumulation in peripheral body areas (Gaudineau et al, 2010). Many researchers are concerned with the impact of regular and intensive sport performance on menarcheal age. Some scientists recorded later onset of menarche in physically active girls (Malina et al, 1978; Frisch et al, 1980). According to cross-sectional study about adolescent girls in Central India the average age at menarche was statistically significantly higher in girls who performed intensive sport activities in comparison to physically inactive girls (Dambhare et al, 2012).

The objective of the this study is to determine the current average age at the first occurrence of menstruation in Slovak adolescent girls and to follow up on the studies of similar focus of our Slovak predecessors (Gerová et al, 2008; Kovalcíková, 1990, 1991). We aimed to supplement information about this issue with data obtained from various ethnic, socioeconomic groups or geographic regions, for, as known, data about menarcheal age differ in dependence on several factors and change in time. As many exogenous factors (nutrition, the amount of physical activities, socioeconomic conditions, and life style) may impact on the timing and the course of reproduction functions, it is important to keep on updating information about the menstrual cycle of adolescent girls. Our aim was to investigate if the onset of the first menstruation is dependent on the girls' place of residence (urban or rural) and the amount of sport activities performed by girls before menarche. In addition, our intention was to find out if the frequency of appointments with the gynaecologist after menarche depends on the place of residence (urban – rural). Updated information about the menarcheal age, as well as about factors which can modify the onset of menarche, is important for parents, educators, pedagogues, doctors and medical staff.

2. Problem Statement

Rural and urban origin has a many differences (for example: life style, nutrition, environment, economic status). Rural and urban origin is key determinant for health status and health literacy.

3. Research Questions

1. Do differences exist in health status (menarche, underweight, overweight, obesity) between rural and urban women?
2. Do differences exist in health literacy (sport, appointment with gynecologist and smoking) between rural and urban women?

4. Purpose of the Study

We aimed to obtain data from various socioeconomic groups or geographic regions, for, as known, data about menarcheal age differs depending on several factors such as sport, socioeconomic conditions,

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and life style. A secondary aim was to find out if frequency of appointments with the gynaecologist after menarche depends on the place of residence.

5. Research Methods

This survey was a cross sectional study. The sample consisted of 411 female students of the last year at secondary school and the first year at university in Nitra (the Slovak Republic). The mean age of the students was 18.801 ± 1.873 years. The sample was ethnically homogeneous, as all the girls were Slovak, coming from various regions of Slovakia. The female students were randomly selected.

Firstly, the adolescents of the sample were interviewed, thus, we could determine the state of their health and inform them about the research focus. In the case that a respondent did not answer a question, she was excluded from the corresponding sample. The anthropometric method of determining body height and body weight and a questionnaire was used in the study. The anonymous questionnaire served for determination of demographic data (place of residence – urban or rural) and the date of the first occurrence of menstruation. The date of menarche was determined by retrospective recall; i.e., the respondents recalled the day and reported it. Some authors consider it to be inaccurate, as women may not remember the exact date, especially if menarche occurred before a longer period of time (Cravioto et al, 1987). However, several authors assume that women do remember well such significant event as the first menstruation is (Harris et al, 2008; Rigon et al, 2010; De Sanctis et al, 2014) and use it as a scientific research method. In addition, some research studies state the reliability of retrospective recall method to be 75 – 90 % (Damon & Bajema 1974).

Next, we investigated if the mean age at menarche is related to the type of place of residence (urban – rural) and the performance of sport activities before the onset of menarche (performing sport activity >6 hours per week, without sport activity < 2 hours per week). The considered sports were volleyball, handball, basketball, athletics and gymnastics. Girls trained these sports intensively in sport clubs. Within the general characterisation of the sample we surveyed if the girls smoke and also if they arrange regular appointments at their gynaecologist after the first occurrence of menstruation. Nonparametric test methods were used for investigation of statistical dependence of the observed signs. After data obtained from the questionnaires were collected, they were processed by methods of descriptive statistics. For the statistical analysis of the obtained data nonparametric test methods were used: the Pearson χ^2 - test for an association table, the χ^2 - test of independence and the Kruskal–Wallis test, which is a nonparametric analogy of one-factor analysis of variance. Significant differences were evaluated at two levels of significance: *$p \leq 0.05$ (5%), **$p \leq 0.01$ (1%). Mathematical and statistical analysis were determined using statistical package Statistica 7 cz (Statsoft, Czech republic). The essential condition for successful realization of the research was to gain a written consent of the students to examination with the use of questionnaire and evaluation of the obtained data in accordance with the World Medical Association Declaration of Helsinki 1975. All authors have no conflicts of interests to declare.

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6. Findings

The mean values of age, height, weight and BMI as well as the influence of the place of residence (urban – rural) on these parameters and sport activity, seeing gynaecologists and smoking are shown in Table 1. The mean age of participants was 18.80 ± 1.87 years, the average body height was 166.96 ± 0.06 cm, and the average body weight was 57.91 ± 8.76 kg. From the obtained anthropometric parameters the average BMI value of the whole sample was calculated (20.76 ± 2.77). After dividing the sample into weight categories according to BMI we found out that most girls – 282 (which is 71.94 % of the total number 395) – were in the normal weight category. As much as 82 girls (20.92 % of the total number) were underweight. On the other hand, only 23 girls (5.87 % of total 395) were overweight. Obesity was detected in 5 girls (which is 1.28 %). In the sample divided according to the place of residence (urban – rural) we registered similar BMI values. However, high percentage of underweight girls (42 girls, which is 25 % of the total number of girls) was identified among urban girls. We used the χ^2- test of independence for contingency table in order to determine if BMI values of urban and rural girls differ at a significant level. The test did not prove the BMI values of urban and rural girls to be significantly different ($\chi^2 = 4.34234$, p = 0.226800) (Table 1). Table 1 shows also the percentage expressing the physical (sport) activity or inactivity of urban and rural girls. In the urban areas 73 girls (42 % of total 174 urban girls) perform physical activity more than 6 hours per week, whereas in the rural areas it is 86 girls (37 % of total 231 rural girls). The aim of the statistical analysis was to determine if there is any significant difference between a physical activity of urban and rural girls before the first occurrence of menstruation. The test proved that the observed differences between the amount of physical activity performed by urban and rural girls are not statistically significant ($\chi 2 = 0.928991$, p = 0.335128) (Table 1).

Arranging regular gynaecologist's appointments after the onset of menarche was stated by 65 urban girls (38 % of total 173 urban girls) and 65 rural girls (28 % of total 231 rural girls). In order to test the hypothesis H_0 claiming that girls from rural residences and girls from urban residences see their gynaecologists equally often we used the χ^2- test of independence for an association table. The test results imply that the frequency of gynaecologist's appointments is significantly dependent on the girls' place of residence. Based on the test results we conclude that urban girls see their gynaecologists more often than rural girls ($\chi^2 = 4.03378$, p = 0.044601) (Table 1). Further, we intended to find out if the girls within the observed sample smoke tobacco products and if there are any differences between urban and rural girls as far as this habit is concerned. We registered equal percentage of smokers (21 %) among both the urban and the rural girls. In order to test the hypothesis H_0 claiming that urban and rural girls smoke in equal extent the χ^2- test of independence for a contingency table was used. As far as the habit of smoking is concerned, there are no significant differences between urban and rural girls ($\chi^2 = 0.122281$, p = 0.940691), Table 1). The above mentioned results obtained with the statistical analysis of collected data are in accordance with general long-observed trend of diminishing differences between towns and countryside. The evaluation results of factors associated with age at menarche are shown in Table 2.

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Table 01. Anthropometric characteristics and the influence of place of residence (urban – rural) on BMI values, sport activity, appointment with the gynaecologist and smoking

	Whole sample					
	$\bar{x}$ ± SD					
age	18.80 ± 1.87					
body height (cm)	166.96 ± 0.06					
body weight (kg)	57.91 ± 8.76					
BMI (kg/m^2)	20.76 ± 2.77					
BMI categories	N			%		
underweight (<18.5)	82			20.92		
normal weight (18.6 – 24,9)	282			71.94		
overweight (25.0 – 29.9)	23			5.87		
obesity I (30 – 34.9)	5			1.28		
	Urban residence (176 girls)			**Rural residence** (232 girls)		
	$\bar{x}$ ± SD			$\bar{x}$ ± SD		
body height (cm)	167.32 ± 0.07			166.71 ± 0.07		
body weight (kg)	57.49 ± 7.83			58.23 ± 9.39		
BMI (kg/m^2)	20.54 ± 2.61			20.931 ± 2.87		
BMI categories	N	%	$\bar{x}$ ± SD	N	%	$\bar{x}$ ± SD
underweight (<18.5)	42	25	17.68 ± 0.78	42	19	17.52 ± 0.70
normal weight (18.6 – 24.9)	119	70	21.07 ± 1.65	164	72	21.04 ± 1.70
overweight (25.0 – 29.9)	7	4	27.01 ± 1.79	16	7	26.47 ± 1.29
obesity I (30 – 34.9)	1	1	31.63	4	2	30.43 ± 0.45
no response	7			6		
	χ^2 - test of independence: 4.34232, df =3, p = 0.226800					
sport activity	N	%		N	%	
yes (> 6 hours per week)	73	42		86	37	
no (< 2 hours per week)	101	58		145	63	
no response	2			1		
	Pearson χ^2 - test: 0.928991, df =1, p = 0.335128					
seeing gynaecologist	N	%		N	%	
yes	65	38		65	28	
no	108	62		166	72	
no response	3			1		
	Pearson χ^2 - test: 4.03378, df =1, p = 0.044601*					
smoking	N	%		N	%	
yes	36	21		49	21	
no	111	64		149	65	
sometimes	27	15		33	14	
no response	2			1		
	Pearson χ^2 - test: 0.122281, df =2, p = 0.940691					

Notes: N – number, $\bar{x}$ – average, SD – standard deviation, df – degree of freedom, p – value of probability, *p<0.05; **p<0.01

The average menarcheal age of adolescent girls in the observed sample is 12.950 ± 0.88 years. The average menarcheal age of urban girls in the sample is 13.020 ± 0.85 years, and the average menarcheal age of rural girls in the sample is 12.901 ± 0.87 years. Next, we calculated the average menarcheal age with respect to the amount of physical activity performed by girls before the onset of menarche. The average menarcheal age of the girls who stated that they had been physically active before menarche (> 6 hours per week) was 13.296 ± 0.87 years. On the other hand, the average menarcheal age of the girls who stated that they had not performed sport activities regularly before menarche was 12.792 ± 0.81 years. The average menarcheal age of urban girls who performed intensive sport activities before menarche was 13.359 ± 0.75

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years, and for urban girls who did not perform intensive sport activities before menarche the average menarcheal age was 12.818 ± 0.84. For rural girls these values were 13.227 ± 0.99 and 12.774 ± 0.79 years respectively. In order to determine if a sport activity has a significant impact on the age at menarche, the Kruskal-Wallis test was conducted. The Kruskal – Wallis test served as a tool for investigating if an active sport performance is a factor which has a significant impact on the age at menarche. This implies that the average menarcheal age of physically active girls and the average menarcheal age of physically inactive girls are different (Table 2). The observed differences are significant (K = 32.49630, p = 0.0000). The results of our research prove that an active sport performance has a statistically significant impact on the age at menarche; intensive sport performance delays the onset of menarche.

Table 02. Age at menarche according to selected factors (place of residence: urban – rural, amount of sport activity before menarche)

Age at menarche		
	$\bar{x}$ **± SD**	
whole sample	12.950 ± 0.88	
urban residence	13.020 ± 0.85	
rural residence	12.901 ± 0.87	
sport activity before menarche	$\bar{x}$ **± SD**	
yes (> 6 hours per week)	13.296 ± 0.87	
no (< 2 hours per week)	12.792 ± 0.81	
	Urban residence	**Rural residence**
sport activity before menarche	age at menarche $\bar{x}$ ± SD	age at menarche $\bar{x}$ ± SD
yes (> 6 hours per week)	13.359 ± 0.75	13.227 ± 0.99
no (< 2 hours per week)	12.818 ± 0.84	12.774 ± 0.79
	Kruskal–Wallis test = 32.4963, p = 0.0000*	

Notes: $\bar{x}$ – average, SD – standard deviation, df – degree of freedom, p – value of probability, *p<0.05; **p<0.01

The presented study comprises update information about the average age at menarche of Slovak adolescent girls and an analysis of possible associations between selected factors (a place of residence: urban – rural, performance of intensive sport activities before menarche) and the age at the first occurrence of menstruation. The last related study in Slovakia evaluated the influence of intensive physical education on organisms of girls, and the menarcheal age of girls who performed intensive sport activities. Values of age at menarche more than 13 years were recorded in tennis players, swimmers and gymnasts (Kovalcíková, 1991). According to our calculations the average menarcheal age of present Slovak adolescent girls is 12.950 ± 0.88 years. This value is in accordance with data reported in other countries. Italian researchers report the average menarcheal age to be 12.40 years, and they add that 95 % of Italian girls have menarcheal age within range from 10 to 15 years (De Sanctis et al, 2014). According to cross-sectional study among adolescent girls in Central India the average menarcheal age to be 13.51 ± 1.04 years in urban girls and 13.67 ± 0.8 years in rural girls (Dambhare et al, 2012). The researchers investigated menstrual characteristics of adolescent girls in Ghana. They reported the average menarcheal age to be 12.5 ± 1.28 years (Gumanga & Kwame-Aryee, 2012). Other researchers studied the onset of the first menstruation of 1273 secondary school students in Kuwait. The average menarcheal age was 12.41 years (95 % CI: 12.35 – 12.48) (Al-Awadhi et al, 2013). The average menarcheal age of Iranian girls aged from

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12 to 18 to be 13.06 ± 1.24 years (Tehrani et al, 2014). During the last century, a constant and gradual decrease of age at menarche was recorded in many countries all over the world (Wyshak & Frisch 1982). Fredriks et al. (2000) recorded the decrease of median menarcheal age of Dutch girls approximately by one month in ten years. The decrease by approximately 2.5 months of the average menarcheal age was recorded in women in the USA in the period 1963 – 1970 and 1988 – 1994 (Anderson et al, 2003) and another decrease approximately by 2.4 months in the period 1988 – 1994 and 1999 – 2002 (Anderson & Must, 2005). The average menarcheal age in the USA decreased from 13.3 years (95 %; 13.2 – 13.5) recorded in women born before 1920 to 12.4 years (95 %; 12.2 – 12.5) which was recorded in women born between 1980 and 1984, and this decrease of menarcheal age was observed in all ethnic groups (McDowell et al, 2007). In Tokyo the median value of menarcheal age decreased from 15.1 years recorded in women born before 1900 to 12.5 years which was recorded in women born in the 1960s (Miura et al, 1986). Several studies were also conducted in Europe. Researchers in Norway investigated the onset of menarche in women who were born between 1830 and 1960. The menarcheal age decreased from 16 years which was recorded in women born around 1830 to 13 years in women who were born around 1960, though the decrease was not exactly linear (Rosenberg, 1991). Recent studies report stabilization of menarcheal age around 12 – 13 years (Liestol & Rosemberg 1995; American Academy of Paediatrics, 2006; Euling et al, 2008; Rigon et al, 2010).

There are some opinions that currently, puberty is just getting back to the former numbers. Members of archaic human communities (the Pleistocene, more than 10 000 years ago) entered puberty as early as at the age of 7 (between the 7th and 13th year of age), and thus they could acquire the full reproduction competence between the 9th and 15th year of age. Menarche and social maturity were in close relation just in the recent past (a hundred years ago), and probably in the archaic communities, too. Considering the shortness of their life span, the early reproduction maturity was an important adaptation advantage for the past human populations; yet, nowadays it does not seem to be an advantage anymore (Gluckman & Hanson 2006).

Menarche is also delayed due to malnutrition, emotional deprivation, overload of the organism by early and excessive training in professional sportswomen (e. g. athletes and ballet dancers), chronic illnesses etc. Controversy related to Frisch theory of "critical body weight" (Frisch, 1985) – the threshold essential for the maintenance, restoration or the onset of regular menstrual cycle was investigated by many studies, which mainly concerned menstrual dysfunction of sportswomen (especially female marathon runners or ballet dancers) (Frisch et al, 1980). Delays of menarche or amenorrhea indicated the possibility of certain physiological adaptation to huge metabolic demands. Research conducted on 1017 Turkish gymnasts aged from 12 to 19 found similar conclusions; the obese girls in their sample had significantly lower age at menarche (Ersoy et al, 2004). According to other researchers the average menarcheal age of present adolescent girls in the USA is 12.5 years, and the average menarcheal age of obese girls in the USA is 11.9 years (Kaplowitz, 2008).

Another evaluated factor associated with age at menarche which we evaluated in the study was the place of residence (urban – rural). The average menarcheal age of urban girls was 13.020 ± 0.85 years, for rural girls it was 12.901 ± 0.87 years. We assume that the higher menarcheal age of urban girls in comparison to the menarcheal age of rural girls is related to the higher percentage of underweight girls

among urban girls, and also to the higher percentage of girls who performed sports intensively before menarche (> 6 hours per week) among urban girls. Both these factors contribute to delay of menarche onset.

The influence of long-term and systematic sports training on the onset of the first menstrual cycle in sportswomen in various sports has been investigated by many authors. However, not all their results are definite. Some researchers came to the conclusion that the onset of menarche of sportswomen was slightly delayed; however, the difference was not significant (Geithner et al, 1998). Other researchers recorded delayed onset of menarche in physically active girls (Malina et al, 1978; Frisch et al, 1980). It is assumed that the loss of energy during intensive physical exercise, lower mass of body fat and low body weight can affect the activity of hypothalamic centres for sexual maturation, which can cease this process and cause primary amenorrhea (considerable delay of menarche) (Warren, 1980).

7. Conclusion

In the sample that we observed we recorded similar associations. The average age at menarche (13.296 ± 0.87) was higher in the girls who performed intensive sport activities before the onset of menarche in comparison to the girls who did not perform regular and systematic sport activities (12.792 ± 0.81), which is in accordance with results of other current researches proposing that intensive sport performance can delay menarche. Our results confirm that the factor of intensive sport performance has a statistically significant impact on age at menarche, and performing regular intensive sport activities delays the inset of menarche. No significant differences were recorded between urban and rural girls as far as the habit of smoking tobacco is concerned.

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