Comparative Analysis of Heart Rate Variability During Different Phases of Menstrual Cycle in Eumenorrhea & Dysmenorrhea Subjects

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Heart rate variability among eumenorrhea & dysmenorrhea subjects was compared. Different phases of menstrual cycle in eumenorrhea subjects showed no difference in time domain parameters of HRV. In dysmenorrhea subjects there was a significant increase in parasympathetic activity in follicular phase compared to menstrual phase. This suggests the complex physiological homeostatic mechanisms plays a role to maintain autonomic balance even when the autonomic disturbances occur.

Key words: menstrual cycle, eumenorrhea, dysmenorrhea, Heart rate variability.

Peculiarities of Secular Trend of Physical Development Formation in Children Across Europe

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Introduction. Study of the growth and development patterns in children and adolescents is one of the important trends in age of biology. Physical development along with birth rate, morbidity and mortality is one of the leading public health criteria. In its turn, the level of physical development significantly influences the course of all the major functions of the body and defines the boundaries of their adaptive capacities. According to many authors, physical development predetermined by genetics on 20%, though its main indicators used traditionally in European countries and recommended by WHO experts (constitutional height, weight, body mass index) may significantly vary due to physical activity, a number of environmental factors, and psycho-emotional, socio-economic factors [10, 18].

The longitudinal studies of anthropometric parameters allow to obtain objective information required for performance of comprehensive preventive measures among different age and gender groups of children population [4, 1]. It should be noted, that the physical development parameters exert dynamic spatio-temporal fluctuations that result in their territorial characteristics and multidirectional changes in the morphological status of children over certain bigger or smaller periods (decades, centuries). In its turn, this requires harmonization of national standards for assessing of the physical development of children of school age with the complex of local climatic and geographical, socio-economic and environmental factors.

The purpose of the study included the determination of secular trend of certain morphological indicators of 8-year-old schoolchildren in Lviv, examined in 2003-2005 and 2013-2014, determining the differences between the Ukrainian evaluation criteria of the physical development of children of school age...
Materials and methods. According to conventional anthropometry methods, we examined pupils of 2nd grade in secondary schools of municipal general educational establishment. In 2003-2005 179 children, 8 year-olds (boys – 94, girls – 85) were examined. During 2014-2015 the study covered 459 children, including 236 boys and 223 girls. Selective totality was formed based on the selection by similar age, gender and material and household characteristics (qualitative representation) and quantitatively sufficient (quantitative representativeness) of the population examined. Calculating of the accurate calendar age of children was conducted according to the recommendations of WHO experts (web-site: easycalculation-day/age.php). The group of 8-year-old children included school children aged between 7 years 6 months and 8 years 5 months 29 days.

With the purpose of subsequent hygienic assessment of anthropometric parameters junior school pupils who study in educational institutions of different types, the obtained values were compared with control values in accordance with the evaluation criteria of physical development of schoolchildren in Ukraine. Harmonicity of physical development was evaluated by the value of the body mass index (BMI) as a ratio of body weight (kg) to the square of height (m).

Statistical analysis of the reliability of differences between the mean values of physical development in corresponding gender and age-specific groups was performed by the generally accepted methods for biomedical research using MS Excel program. The threshold of statistical significance was within limits no greater than \( p < 0.05 \).

Results. Accomplishment of our specified objective was performed by means of comparison of defined values of body weight and height with 10-year interval in 8-year old children in Lviv (Table 1).

<p>| Table 1 |
|---|---|</p>
<table>
<thead>
<tr>
<th>Years</th>
<th>Groups of children</th>
<th>Parameters (M±m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003–2005</td>
<td>Boys n-94</td>
<td>127.12 ± 0.43</td>
</tr>
<tr>
<td></td>
<td>Girls n-85</td>
<td>125.26 ± 0.70</td>
</tr>
<tr>
<td>2013–2014</td>
<td>Boys n-236</td>
<td>131.29 ± 0.31*</td>
</tr>
<tr>
<td></td>
<td>Girls n-223</td>
<td>129.79 ± 0.34*</td>
</tr>
</tbody>
</table>

* \( p < 0.001 \).

Program of the physical development assessment in 2003-2004 did not include determination of chest circumference, as there is a direct correlation between the above anthropometric parameter and body weight. We had revealed that within ten-year period there was a significant increase in both height and weight of children in both gender groups. Height of second grade students in 2013-2014 exceeds the later in 2003-2004 in boys by 4.17 cm and 4.53 cm for girls. The secular trend of body weight was with 3.94 kg for boys and 3.68 for girls.

Based on a comparison of physical development parameters, determined by the results of our research and the values specified in the Order of Ministry of Health of Ukraine N 802 for children of the respective age group it was found that there is a significant difference \( (p < 0.02) \) in values of height in 8 year-old boys as well as girls. Height of boys in Lviv is 2.26 cm higher and 1.80 cm higher for girls (Table 2). Body weight of the examined boys is higher
than the normative value by 1.20 kg ($p < 0.02$). There were some differences in values chest circumference in both sex groups. Given value in Lviv’s boys is higher than all-Ukrainian parameter by 0.75 cm, the difference across girls is 1.18 cm ($p < 0.02$).

Table 2

### Comparison of average parameters of physical development in 8-year old children from municipal general educational institutions (MGEI) with criteria for assessing of the physical development in children of school age

<table>
<thead>
<tr>
<th>Groups of children</th>
<th>Parameters</th>
<th>MGEI</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Height</td>
<td>Body weight</td>
<td>Chest circumference</td>
</tr>
<tr>
<td></td>
<td>boys</td>
<td>girls</td>
<td>boys</td>
</tr>
<tr>
<td></td>
<td>128.93 ± 0.43</td>
<td>128.93 ± 0.43</td>
<td>131.29 ± 0.31*</td>
</tr>
<tr>
<td></td>
<td>28.43 ± 0.26**</td>
<td>63.28 ± 0.24</td>
<td>28.61 ± 0.35</td>
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<td>63.28 ± 0.24</td>
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</table>

** - $p < 0.02$.

Thus, determined within our survey anthropometric parameters of younger schoolchildren are significantly higher than the national average parameters as well as previous values that were established based on our research in 2003-2005, indicating a process of acceleration of physical development of children in western Ukraine and coincides with the general European trends of the last decade. This is confirmed by comparing the height and body weight parameters in Lviv’s 8-year-old schoolchildren with similar parameters of their peers in other countries.

In 2010-2011 in Gomel (Belarus) anthropometric survey was conducted in 2894 schoolchildren aged 7-17 years, including a group of 8-year-old children consisting of 269 children (143 boys and 126 girls) [5]. Statistically average basic parameters of physical development (height, body weight, chest circumference) of Belarusian male schoolchildren were 130.01 ± 0.43, 29.09 ± 0.43, 63.55 ± 0.41, for female schoolchildren – 129.01 ± 0.50, 28.37 ± 0.48, 62.96 ± 0.47, respectively. Out of these data only height among boys is significantly lower ($p < 0.02$) from that of values in Lviv. According to the physical development assessment of 251 children of elementary school (132 boys and 119 girls) in Lithuania (2013), the following values of height and body weight were established: boys – 130.50 ± 0.57, girls – 128.20 ± 0.54 and 29.40 ± 0.55 and 27.50 ± 0.49, respectively [9]. Height of the girls is lower by 1.59 cm ($p < 0.02$) compared with that for Ukrainian children.

In our opinion, the results of the study of reference values of height and body weight of Polish schoolchildren (2008-2009) are very indicative. This direction of the research was a comprehensive part of the research “Elaboration of the blood pressure normal reference range for the children and youth population in Poland”, under which measurements of physical development of 17573 boys and girls aged between 7 and 18 years old were conducted [16]. The number of 8-year-old population was 1404 (715 boys and 693 girls). Average height for boys amounted 130.60 ± 0.21, body weight – 28.80 ± 0.29, for girls – 129.30 ± 0.23 and 27.70 ± 0.22, respectively, i.e. differences of anthropometric parameters of primary schoolchildren in two neighboring European countries are unreliable.

Among the indicators recommended by WHO experts traditionally used in European preventive medicine in determining the harmonicity of physical development of children much attention is paid to calculation of body mass index (BMI, Quetelet index, biomass-index). Based on research of Ukrainian researchers, biomass-index parameters for 6-17-year-old children were processed [7]. For 8 year-old boys the normal value is 14.75-17.98 kg/m², and for
the girls, 14.72-17.66 kg/m². The values provided are proposed to use for the purpose of screening assessment of physical development of the children population. Accordingly, the children are classified into the following categories: normal, the body weight deficit, excess body weight, malnutrition and obesity.

At the first stage of the study (2003–2005) the average values of the parameter in boys was 15.73 ± 0.40 kg/m² (min-13.22; max-19.21) and in girls, 15.47 ± 0.33 kg/m² (min – 12.95; max – 19.56). According to the survey in 2013-2014 (second stage), it was established that BMI value of the examined 8-year-old schoolchildren are within the normal reference range and for boys it is 16.52 ± 0.42 kg/m², for girls, 15.85 ± 0.38 kg/m², respectively (Figure). Along with that, fluctuation limits of the minimum and maximum parameters (boys – 12.20-21.89 kg/m², girls – 13.04-22.11 kg/m²) correspond to the malnutrition and obesity category. According to the Lithuanian research data among younger male schoolchildren BMI is 17.1 kg/m² and among female representatives, 16.7 kg/m², respectively. In Poland, the BMI of boys and girls was equal to 16.7 kg/m² and 16.4 kg/m². These values indicate no significant difference between defined in Ukraine indicators in 2013–2014. Given that the average BMI parameters did not go beyond the normal reference range, overall, physical development of children population can be assessed as harmonious.

Discussion. The key trends of physical development is acceleration and deceleration, changes in the rate of somatic development compared to the similar parameters in previous generations. Epochal fluctuations of basic characteristics is inherent to many physiological and functional parameters, such as the cardiovascular system state, the speed of reactions formation, language functions, etc. (E. Godina 2009; M. Hermanussen, E. Godina, F.J. Rühlietal 2010) [2, 14].

Our studies clearly demonstrate pronounced acceleration trends in the physical development of primary school children in Lviv over the last decade. Obviously, the mechanisms of growth acceleration in children do not have only local incidence. These phenomena are observed in other European countries, including Poland. In the 60–80th of last century Polish researchers studied changes in the morphological status of schoolchildren of different age groups. Data by Z. Ignasiak, T. Sławińska indicate that height as well as body weight in 8–10 year-old children in the period from 1961 to 1980 were significantly increasing, especially among girls [15]. Anna Radochońska and colleagues analyzed the dynamics of physical development parameters in 7-14-year-old
children based on the measurements conducted in 1976-1977, 1988-1989 and 2003-2004. In the period of 1988-1989 to 2003-2004 among all age groups of girls and boys from 7.5 to 10.5 increase in the body dimensions was established [17]. Based on the comparison of anthropometric parameters of examined children in 2003-2005 with the regional standards of physical development of schoolchildren in 1995-1996, it was found that the probable exceedance of height and body weight was observed in the first grade in all the children, who began training at school from 6 years of age, and in the second grade it concerned only the height of boys, whose age at the admission to school was 7 years old. The above dynamics of anthropometric parameters of younger schoolchildren suggests certain characteristics inherent to the manifestation of secular trend of physical development formation in children across Europe.

Anthropometric data collected from studies of similar children populations are representative materials for creating normal reference ranges (standards) of physical development. While determining the standards of the physical development it is crucial to determine the feasibility of using the average statistical regional growth and formation parameters of a child’s body in a particular area or use of the average statistical parameters. WHO reference growth tables were created based on optimal parameters of the children population who have been specifically selected to participate in the survey [11, 12]. Comparison of parameters of normal physical development by international standards with values of national standards is 2:1, i.e. out of the two children with normal physical development by the WHO- standards, only one was normally and harmoniously developed. Informativeness of the application of international standards (Z-scores BMI-for-age) as the only standard for assessing of the physical development does not exceed 50 %, and therefore does not allow to detect deviation and conditions, caused by low functional abilities of the respiratory and muscular systems of the child’s body [6, 8].

Nowadays, great importance is attributed to the study of environmental factors influence on the age variability of morphological parameters of the child’s body on the population as well as on the individual levels. That is why anthropologists who traditionally work with different population groups hold on to the principle that standards of physical development, normative or evaluation tables must be based on materials obtained during the examination of specific cohorts and related to specific local conditions and time zones [13].

Large areas of our country differ in characteristics of landscape conditions, peculiarities of business activity and way of life of the population, which in turn requires a regional approach regarding study of the physical development of children and adolescents. According to the generalized landscape, climate and weather, environmental hygienic characteristics of Ukrainian territory grouping of the regions into the southern, southwestern, western, central, eastern and northern is applied. We believe it is appropriate to process standard normative values of anthropometric parameters in children under the specified distribution of administrative units and consider active migration processes inherent to present day. The proposed normal reference range and evaluation of the physical development of children should consist of at least six variants of regression scales or centile tables and curves.

**Conclusions.** Our studies clearly demonstrate marked acceleration trends in physical development of elementary schoolchildren in Lviv over the last decade. Dynamics of anthropometric parameters of elementary schoolchildren confirms the peculiarities of formation of the secular trend in physical development of children in different European countries. Based on the ratio of body weight and body height, assessed by body mass index, we can conclude on the predominance of harmonious physical development of elementary schoolchildren in Lviv and neighboring European countries.
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RESEARCH ARTICLE

Peculiarities of Secular Trend of Physical Development Formation in Children Across Europe

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Assessment of anthropometric parameters of junior 8-year-old schoolchildren in Lviv was performed, determined with 1-year intervals followed by comparison of obtained parameters with normative values in accordance with the evaluation criteria of physical development of schoolchildren in Ukraine. In comparative aspect, peculiarities of secular trend of physical development formation in children across Europe were assessed. It was recommended to process normative values of anthropometric parameters in accordance with grouping of regions into the southern, southwestern, western, central, eastern, and northern based on generalized landscape, climatic and environmental hygienic characteristics of Ukraine.

Key words: schoolchildren, physical development, body mass index, secular trend.

Транскрипційна індукція генів – регуляторів рециркуляції і хоумінгу лімфоцитів madcam1, s1pr1, cxcr4 і ccr7 в умовах експериментального гестаційного діабету, що впливає на розподіл T-клітин у брижових лімфатичних вузлах у нащадків

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Брижові лімфатичні вузли (БЛВ) є основним місцем індукції периферійної імунологічної толерантності до різноманітних антигенів, у тому числі й панкреатичних [13], а також основним “перехідним” пунктом для пулу рециркулюючих лімфоцитів кишково-асоційованої лімфоїдної тканини (КАЛТ). Головними регуляторами хоумінгу лімфоцитів у БЛВ є адресин Madcam1 (mucosal addressin cell adhesion molecule 1) – адгезивний білок венул із високим ендотелієм лімфоїдних утворень КАЛТ, хемокінові рецептори Cxcr4 (C-X-C chemokine receptor type 4) і Ccr7 (C-C chemokine receptor type 7), лігандами для яких є Cxcl12, Ccl19 і Ccl21 відповідно. Хемокін-рецепторна взаємодія між параметрами Ccl19/21–Ccr7 та Cxcl12–Cxcr4, а також Madcam1 та його лігандом інтегрином α4β7 регулюють надходження до ЛВ більшості імунних клітин. Так, вхід T-клітин у ЛВ порушується за відсутності Cer7-сигналації, в тому числі у мишій лінії plt/plt, які не мають Ccl21, а також Ccl19 [21]. Вихід лімфоцитів із БЛВ своєю чергою регулюється сфінгозин-1-фосфат S1P-рецепторами (S1pr1–S1pr5) [23], серед яких лімфоцитами найбільш активно експресується перший тип – S1pr1 [20]. Після активації імунних клітин у БЛВ експресія S1pr1 на їх мембрані зростає, а лімфоцити реагують на зміни градієнта S1P і завершують лімфатичні вузи [9].

Мета дослідження – з’ясувати рівень експресії мРНК генів Madcam1, S1pr1, Cxcr4 і CCR7 і його вплив на розподіл Th1-, Th17- і Treg-клітин у брижових лімфатичних вузлах у нащадків шурів з експериментальним