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# Comparative Characteristics of Physical Development of Schoolchildren in Moscow and Kiev

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## Abstract

The aim of this study was to find peculiarities in processes of growth and development of the child and adolescent in different megalopolises, *Moscow and Kiev,* on the background of various social and economic changes in society and standards of living of the child population. Comparison analysis of physical development of Moscow and Kiev children did not show statistically significant differences in body length except in boys aged between 10 and 16 years and in girls aged between 12 and 17 years. The changes in physical development of Kiev children demonstrate a domination of gracilization, accompanied by significant low values of body mass with high values of body length, especially in girls. The study showed that modern adolescents of both cities exceed their peers from previous generation in body length. Chest circumference in all ages of both sexes and body mass starting from 10 years of age were higher in adolescents from Moscow. We found a negative trend to the increase in the number of overweight Moscow children in the studied dynamics. **(Int J Biomed. 2016; 6(4):279-282.)**

**Key Words**: physical development • children • adolescents • body mass • body length

## Introduction

Due to the incompleteness of the processes of growth and development of young people of school age, children and adolescents have an increased sensitivity to the adverse effects of exogenous factors, and, simultaneously, to the positive impact of preventive measures aimed at preserving and improving health in organized children's groups.[1-3]

The importance of studies of growth and development of the younger generation for childhood hygiene has been repeatedly noted by Russian scientists.[4-6,11] One of the most essential directions of such studies is to establish changes in the physical development of children in "homogeneous groups," the characteristic of morphological and/or functional changes in the development of the child population.

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The aim of this study was to find peculiarities in processes of growth and development of the child and adolescent in different megalopolises, Moscow and Kiev, on the background of various social and economic changes in society and standards of living of the child population. We studied the interdependence of growth and development on children (between 8 and 17 years old) – the residents of the two capitals – by comparing the results of the two parallel studies.

## Material and Methods

Our study was carried out by a natural hygienic experiment with the use of epidemiological studies in schools of Moscow and Kiev. Written informed consent was obtained from the *child's parents.* The work did not infringe on the rights and did not endanger the welfare of study subjects and met the requirements of biomedical ethics.

The participants were children and adolescents of the Moscow and Kiev regions who were born and lived in these

cities (Russians, Belarusians, Ukrainians and also children from mixed marriages); 762 students from Moscow region and 612 from Kiev region were examined in the dynamics of learning from 1st to 11th grade.

We studied the physical development of children by unified methods with the use of standard tools,[4] as well as the somatometric indicators of physical development (body mass and body length, chest circumference) . The evaluation of the physical development of Moscow schoolchildren was carried out by regional modified scales of regression of body mass (BM) on body length (BL), and in Kiev by aged-sex regression scales of BM on BL. In fact, the principle of building these standards is identical, but in each state they are approved by the Ministry of Health alone.

The statistical analysis was performed using the statistical software «Statistica» (v6.0, StatSoft, USA). The mean (M) and standard error of the mean (SEM) were calculated. For data with normal distribution, inter-group comparisons were performed using Student's t-test. Pearson's correlation coefficient (r) was used to determine the strength of the relationship between the two continuous variables. A probability value of $P<0.05$ was considered statistically significant.

## Results

It has been shown that physical development in the two cities is subject to the general regularities: sex dimorphism and heterochrony of development. However, children and adolescents of Moscow and Kiev were found to have some differences in the main physiometric indicators of physical development: the respiratory capabilities of children in Kiev in all age-sex groups were significantly lower than in Moscow groups.[7,10]

The studies showed that modern adolescents of both cities exceed their peers from previous generation in body length. Moscow children also have higher BM and chest circumference (ChC) than their peers of the 1960s and 1980s, while modern children of Kiev have less BM and ChC than their peers of 30 to 50 years ago.[8,9]

The findings of the change in total body sizes in Moscow children show positive shifts in physical development, which may be associated with positive changes in the socioeconomic situation. The changes in physical development of Kiev children demonstrate a domination of gracilization, accompanied by significant low values of BM with high values of BL, especially in girls.

Comparison analysis of physical development of Moscow and Kiev children didn't show statistically significant differences in BL except in boys aged between 10 and 16 years (Moscow children had significant higher values) and in girls aged between 12 and 17 years (Kiev girls had significant higher values) (Tables 1, 2).

The analysis of annual increase showed that in both cities girls had maximum BL increase from 11 to 12 years of age, and boys from 13 to 14. In addition, it should be noted that the growth processes of the majority of Moscow girls are completed by age 16 (average annual increase from 16 to 17 was less than 1 cm), while the growth processes of Kiev girls continue longer (average yearly increase from 16 to 17 years old is 1.82 cm). Thus, we can suppose that definitive body sizes in Kiev girls will be greater than in Moscow girls.

***Table 1.***

***Comparison analysis of physical development of Moscow and Kiev boys aged between 8 and 17***

| Age (y) | City | BL(cm) | BM (kg) | ChC (cm) |
|---|---|---|---|---|
| Boys | | | | |
| 8 | Moscow | 129.9±5.0 | 26.5±3.6 | 64.1±3.2 |
| | Kiev | 128.9±4.3 | 27.2±3.2 | 62.5±3.47 |
| | *P* | *>0.05* | *>0.05* | *<0.05* |
| 9 | Moscow | 135.6±5.7 | 31.1±4.0 | 66.1±3.11 |
| | Kiev | 135.9±5.06 | 31.6±4.2 | 64.6±3.83 |
| | *P* | *>0.05* | *>0.05* | *<0.05* |
| 10 | Moscow | 140.9±5.6 | 35.4±4.8 | 67.7±4.32 |
| | Kiev | 138.9±6.34 | 32.7±4.8 | 66.6±4.65 |
| | *P* | *<0.05* | *<0.05* | *>0.05* |
| 11 | Moscow | 146.0±6.6 | 40.0±5.9 | 70.8±4.11 |
| | Kiev | 147.7±5.48 | 39.7±5.8 | 70.7±4.08 |
| | *P* | *>0.05* | *>0.05* | *>0.05* |
| 12 | Moscow | 151.20±0.81 | 44.50±1.07 | 74.10±0.80 |
| | Kiev | 152.87±0.59 | 40.95±0.62 | 72.83±0.41 |
| | *P* | *>0.05* | *<0.01* | *>0.05* |
| 13 | Moscow | 158.60±0.96 | 50.90±1.36 | 77.90±0.88 |
| | Kiev | 158.58±0.66 | 47.77±0.58 | 75.70±0.46 |
| | *P* | *>0.05* | *<0.05* | *<0.05* |
| 14 | Moscow | 165.70±0.96 | 53.60±1.31 | 79.90±0.86 |
| | Kiev | 165.61±0.63 | 52.62±0.67 | 78.21±0.53 |
| | *P* | *>0.05* | *>0.05* | *>0.05* |
| 15 | Moscow | 172.21±0.84 | 63.31±1.46 | 85.48±0.86 |
| | Kiev | 171.24±0.53 | 59.53±0.78 | 84.20±0.58 |
| | *P* | *>0.05* | *<0.05* | *>0.05* |
| 16 | Moscow | 175.9±0.8 | 67.5±1.6 | 88.4±0.9 |
| | Kiev | 173.32±0.63 | 58.99±0.87 | 84.66±0.50 |
| | *P* | *<0.05* | *<0.001* | *<0.001* |
| 17 | Moscow | 177.5±0.8 | 69.7±1.6 | 90.8±0.9 |
| | Kiev | 175.68±0.59 | 63.48±0.83 | 88.74±0.69 |
| | *P* | *>0.05* | *<0.001* | *>0.05* |

The BM of modern children and adolescents from 10 years old was higher in Moscow children. Boys aged 10, 12-13 and 15-17 and girls aged 10, 14-15 and 17 had statistically significant differences. ChC was higher in all age groups of both sexes in Moscow children, but boys aged 8-9, 13, and 16 and girls aged 8-9, and 16 had statistically significant differences.

The analysis of harmonicity of physical development of modern Moscow children aged between 8 and 17 years showed that 66.3% of participants had normal physical development. About 22.3% were underweight and 11.3 % were overweight.

In comparison with previous studies,[6] a clear trend to being overweight has appeared among Moscow children since 1980. In the 1980s, 6.6% of children were overweight; in the

1990s, 7.0%; and in the 2000s, 11.2%. Consequently, over the last 30 years the number of children and adolescents who are overweight and obese has increased almost twice.

***Table 2.***

***Comparison analysis of physical development of Moscow and Kiev girls aged between 8 and 17***

| Age (y) | City | BL (cm) | BM (kg) | ChC (cm) |
|---|---|---|---|---|
| Girls | | | | |
| 8 | Moscow | 129.2±5.6 | 25.7±3.7 | 62.5±3.35 |
| | Kiev | 127.9±4.51 | 26.6±3.6 | 61.3±3.37 |
| | *P* | *>0.05* | *>0.05* | *<0.05* |
| 9 | Moscow | 134.5±5.6 | 29.6±4.5 | 65.1±3.32 |
| | Kiev | 134.7±4.64 | 30.7±4.0 | 63.9±3.39 |
| | *P* | *>0.05* | *>0.05* | *<0.05* |
| 10 | Moscow | 140.2±6.0 | 34.6±5.3 | 67.5±4.10 |
| | Kiev | 137.4±5.16 | 32.2±4.9 | 65.7±4.50 |
| | *P* | *>0.05* | *<0.05* | *>0.05* |
| 11 | Moscow | 146.2±7.2 | 39.6±5.9 | 70.1±4.59 |
| | Kiev | 146.4±5.58 | 37.3±5.0 | 69.0±4.63 |
| | *P* | *>0.05* | *>0.05* | *>0.05* |
| 12 | Moscow | 153.20±0.64 | 44.40±0.97 | 74.60±0.79 |
| | Kiev | 155.13±0.59 | 44.09±0.64 | 73.14±0.47 |
| | *P* | *<0.05* | *>0.05* | *>0.05* |
| 13 | Moscow | 159.40±0.60 | 50.70±0.97 | 78.40±0.66 |
| | Kiev | 160.06±0.64 | 48.79±0.59 | 78.26±0.45 |
| | *P* | *>0.05* | *>0.05* | *>0.05* |
| 14 | Moscow | 162.60±0.64 | 53.20±1.09 | 80.40±0.67 |
| | Kiev | 161.99±0.43 | 50.45±0.41 | 79.83±0.41 |
| | *P* | *>0.05* | *<0.05* | *>0.05* |
| 15 | Moscow | 164.25±0.5 | 56.2±1.02 | 82.10±0.6 |
| | Kiev | 163.38±0.49 | 52.25±0.57 | 81.04±0.40 |
| | *P* | *>0.05* | *<0.001* | *>0.05* |
| 16 | Moscow | 164.63±0.53 | 57.41±0.99 | 82.71±0.61 |
| | Kiev | 165.16±0.53 | 55.29±0.64 | 84.38±0.41 |
| | *P* | *>0.05* | *>0.05* | *<0.05* |
| 17 | Moscow | 164.52±0.63 | 58.05±1.35 | 83.47±0.80 |
| | Kiev | 166.98±0.45 | 53.95±0.61 | 83.04±0.45 |
| | *P* | *<0.01* | *<0.05* | *>0.05* |

An increase in the prevalence of excess weight has been observed in modern children. In boys age 8, it was 8.0%; in girls, 5.6%. In boys age 12, it was 16.8%; in girls, 11.0%. the maximum prevalence of excess weight was noticed in boys age 15(17.0%) and in girls age 14(13.1%). This trend was more expressed among boys from 8 to 15 years old: the incidence of overweight boys has increased 3 times. By the age of 17, 13.8% of boys and 10.1% of girls were overweight.

The statistical analysis showed that the level of harmonicity of physical development is mainly kept in the dynamics of study. Pearson's contingency coefficient for boys and girls from 8 to 15 years old was 0.60 (*P<0.001*), 15 to 17 years old was 0.73 (*P<0.001*) and 0.58 (*P<0.002*), respectively. About 18.6% of underweight boys changed to the group of normal physical development by 15 years old, 8.5% of boys with normal physical development moved into the underweight group, and 6.8% moved into the overweight group (Figure 1). Unfortunately, overweight boys from 8 to 17 years old remained in the overweight group. Thus, the boys' overweight group was replenished in the dynamics of maturity. The most dynamic changes were observed in underweight girls. By 15 years old, about 31% of girls change their group to normal physical development (Figure 2), 5.2% of girls moved into the underweight group and 3.5% - into the overweight group. As with the boys, the girls' overweight group was replenished in the dynamics of maturity.

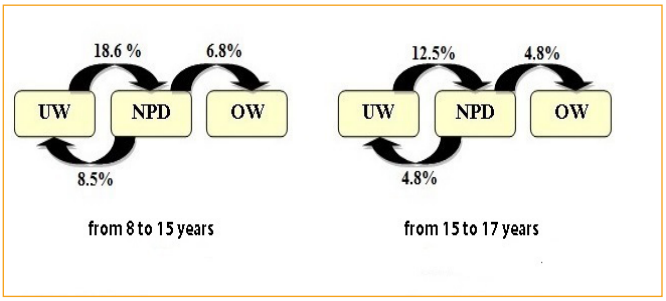


***Fig. 1.***

*UW - underweight boys; NPD - normal physical development; OW- overweight boys*

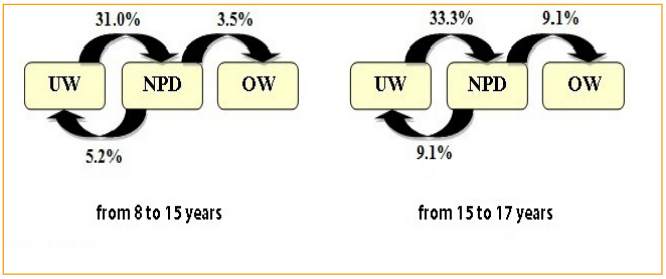


***Fig. 2.***

*UW - underweight girls; NPD - normal physical development; OW- overweight girls*

## Conclusion

In sum, the studies showed that modern adolescents from Moscow and Kiev did not have statistical differences in BL except for boys aged between 10 and 16 and for girls aged between 12 and 17. ChC in all ages of both sexes and BM starting from 10 years of age were higher in adolescents from Moscow. In most age groups of both sexes, the differences were statistically significant.

The analysis of harmonicity of physical development of Moscow children showed the prevalence of an overweight condition in the adolescent population for the last 30 years. In addition, we found a negative trend to the increase in the number of overweight Moscow children in the studied dynamics.

## Competing interests

The authors declare that they have no competing interests.

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