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ADAPTIVE CAPACITY ASSESSMENT OF PRIMARY SCHOOL CHILDREN IN CASE OF VARIOUS FORMS OF ORGANIZATION OF PHYSICAL TRAINING CLASSES

Abstract. *The state of adaptation capacity (AC) of the 4th form pupils has been evaluated. The experimental group (E) included 183 pupils who studied at the school where one of the three physical training classes was held in the swimming pool. Pupils from the neighboring school without a pool, visited three traditional classes of physical culture in the gym and were included into the control group (C, n = 184). The arithmetic mean from Robinson's, Rohrer's and Kerdo's indices was calculated and after obtained values AC was estimated. The children from E group have lower Robinson's and Kerdo's indices in comparison with C group ($t = 2, 65$ and $t = 8, 36$, respectively, $p < 0, 01$). In group E higher proportion of pupils with a high level of AC as compared to the pupils from K group (14,21 and 5,97%, respectively, $t = 2, 64$, $p < 0, 05$). The percentage of schoolchildren with low AC level in E group was lower in comparison with K group (50, 27 and 66, 85%, respectively, $t = 3, 27$, $p < 0, 01$). Thus, swimming exercises during one of the three physical training classes facilitates pupils' efficient and economical adaptation to the educational process.*

Key words: *adaptation capacity, primary school pupils, swimming.*

Introduction: Health of children is a guarantee of a healthy nation. For a long time high sickness rate and occurrence of diseases had been an issue of great concern, and only in recent 4 years these indices have been marked with a tendency to decrease [1]. This state of affairs has stipulated elaboration and fulfillment of certain measures directed to strengthening of health. Although in the majority of cases health-improving initiatives have been introduced without proper hygienic substantiation. One of such innovations is organization of educational process concerning physical training classes. One of the three classes stipulated by the standard curriculum for primary school was held on the basis of a swimming pool.

An effective preventive measure prevents occurrence of pre-morbid conditions without any pronounced clinical signs and reflect disorders of the adaptive process to the environment due to unfavourable effect of certain school factors [2]. Therefore, in order to provide hygienic substantiation of health-improving effect of the classes held in the swimming pool, adaptive capacity of the body should be assessed.

Objective: to assess adaptive capacity of the 4th-form pupils in different forms of organization

of physical training classes.

Materials and methods. On the basis of sanitary examination of 7 comprehensive secondary schools in the city of Kyiv 2 educational establishments have been chosen including one with a swimming pool. Water in the pool is disinfected by means of the most spread method in Ukraine – chlorination.

Similar groups of the study were formed by the results of a questionnaire. Children attending sport clubs after school were not included into the study. Those primary school children who have their physical training classes in the gym were included into the control group (C, n=184). The experimental group (E, n=183) included the schoolchildren from the comprehensive secondary school where classes in the swimming pool are organized once a week.

Adaptive capacity (AC) of the organism was investigated by means of the suggested methods [3]. The study was conducted in two stages: during the first stage anthropometric and physiometric indices were measured, the general score of indices characterizing certain links of adaptive process under conditions of the environment were calculated (Table 1). During the second stage

an arithmetic mean of the obtained score was calculated and AC was assessed.

The significant difference between the groups of the study, according to the signs correlated

Table 1

Indices characterizing certain links of schoolchildren adaptive process under environmental conditions

Index	Calculation formula	Index characterizing
Robinson's index («double product»)	$RbI = \frac{HR \times SP}{100}$	functional heart work load
Rohrer's index	$Ri = \frac{BM}{BH^3}$	physical development and metabolism
Kerdo's index	$Ki = \left(1 - \frac{DCT}{4CC}\right) \times 100$	balance between the links of the vegetative nervous system

Notes: HR – heart rate; SP – systolic pressure, mm Mercury; DP – diastolic pressure, mm Mercury; BM – body mass, kg; BH – body height, m.

with the normal law of distribution, were assessed by Student t-criterion. To find distribution differences between the pupils of different groups according to the level of AC, Pearson χ^2 distribution criterion was used. Calculation, analysis and visualization of the data were conducted by means of the program IBM SPSS Statistics Base v.22, Microsoft Office Excel 2007.

Results and discussion. A reliably higher Robinson's index (Ri) was found among the pupils of both sexes in the C group as compared to the E group ($t=2,65$, $p<0,01$). The average Ri of the boys and girls from the C group was higher than that of a critical value (85 standard units), which is indicative of an intensive systolic work of the myocardium. Ri of the schoolchildren from the E group was equal to the average level of the cardiac muscle functioning. Thus, the functional condition of the cardio-vascular system, degree of economization of functions and aerobic supply of the pupils who do not attend swimming class, were found to be more intensive than those who go in for swimming (Table 2).

Table 2

Indices of adaptive-reserve capacity of the primary schoolchildren organism with different organization of physical training classes

Index	Value of the index ($M \pm m$), su					
	boys+girls		boys		girls	
	C (n=184)	E (n=183)	C (n=93)	E (n=100)	C (n=91)	E (n=83)
Robinson's index	88,44 \pm 1,35	83,57* \pm 1,24	88,18 \pm 1,9	85,55 \pm 1,28	88,70 \pm 1,88	80,78* \pm 2,22
Rohrer's index	11,74 \pm 1,48	12,81 \pm 0,17	11,94 \pm 2,19	12,84 \pm 0,25	11,53 \pm 0,19	12,77 \pm 0,25
Vegetative Kerdo's index	37,88 \pm 1,09	25,38** \pm 1,02	36,78 \pm 1,55	24,40** \pm 1,26	39,00 \pm 1,53	26,55** \pm 1,66

Notes: * $p<0,01$; ** - $p<0,001$, as compared to C group

Rohrer's index is indicative of normal body mass-height ratio between the pupils of both groups examined.

Vegetative Kerdo's index was reliably higher among the pupils of C group as compared to the pupils of E group ($t=8,36$, $p<0,001$). These findings are indicative of certain imbalance between the links of the vegetative nervous system (VNS) of

the pupils from C group as compared to the pupils from the E group. This evidence is similar to the results of our previous studies when cardiointervalography had been performed by means of a portable device FAZAGRAPH®. The tonus of the sympathetic link of the VNS was found to prevail among the pupils of the C group, and the schoolchildren from the E group were

found to be in the state of vegetative balance [4].

Individual AC assessment of pupils was conducted by the results of arithmetic mean calculation from the previously calculated and converted into the points according to the scale stipulating 4 levels of the body functioning: satisfactory adaptation ($\geq 2,67$ points), intensification of adaptive mechanisms (1,67–2,66 points), unsatisfactory adaptation (1,35–1,66 points) and adaptive failure ($\leq 1,34$ points), which correlates with high, moderate, low and critically low assessment of AC.

Among junior schoolchildren from the both examined groups there was no one found with adaptive failure. The reliable difference was found in the distribution of pupils from the C and E groups by AC level ($\chi^2 = 12,50$, $df = 2$, $p < 0,01$). In the C group a part of pupils with high AC level was 2,4 times less as compared to the E group ($t = 2,64$, $p < 0,05$), and the children with low adaptive reserves prevail ($t = 3,27$, $p < 0,01$) (Fig. 1).

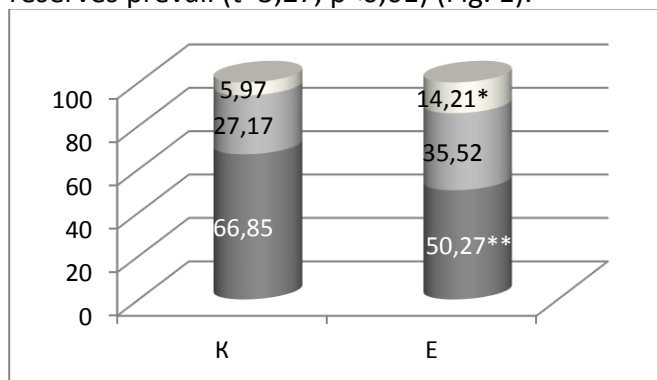


Fig. 1. Distribution of junior pupils with different organization of physical training classes according to the level of adaptive-reserve capacity of the organism.
* $p < 0,05$, ** - $p < 0,001$

Conclusions. 1. Attending swimming classes by schoolchildren promotes better functioning of the cardio-vascular system and vegetative

homeostasis, and Robinson's and Kerdo's indices were reliably lower than those of the pupils attending swimming classes as compared to the pupils from the control group.

2. At the school where one out of three classes of physical training was held on the basis of the swimming pool, a part of pupils with high individual level of adaptive capacity was bigger, and the percentage of pupils with low adaptive reserves was lower as compared to the control educational establishment.

Thus, organization of physical training classes with one out of the three ones on the basis of a swimming pool promotes effective and economic adaptation of pupils to the environmental factors including school surroundings, and therefore, it is health-improving.

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