**International Journal of Medical Science and Clinical Research Studies**

ISSN(print): 2767-8326, ISSN(online): 2767-8342

Volume 01 Issue 06 August 2021

Page No : 143-146

DOI: https://doi.org/10.47191/ijmscrs/v1-i6-04, Impact Factor: 5.276

# Physical Performance Assessment in Adolescents with Autonomic Dysfunction

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**ABSTRACT**

This work is based on the results of a study of assessing physical performance in adolescents with autonomic dysfunctions, depending on gender and the presence of perinatal pathology in the anamnesis. We examined 243 adolescents 12-18 years old with clinically and laboratory-instrumental confirmed dysfunction of the autonomic nervous system - autonomic dystonia syndrome (ADS). The average age of the clinical manifestation of ADS in girls was 12.2 ± 1.8 years, in boys - 13.5 ± 2.1 years. As a result of the study, it was revealed that adolescents with perinatal pathology are less hardy than adolescents without a history of perinatal pathology.

**KEYWORDS:** Adolescents, vegetative dystonia.

**ARTICLE DETAILS**

**Published On:**
**23 August 2021**

**Available on:**
**https://ijmscr.org**

## RELEVANCE

The high prevalence of autonomic disorders in the child population as a whole and, especially, in adolescence, reaching 60-72.1%, affects the functional state of the cardiovascular system [2,3]. Adolescents with dysregulatory deviations of the autonomic nervous system, one of the main clinical manifestations of which are such syndromes as hyperventilation, heart-pain syndrome, make up more than half of all those who apply to pediatricians with pathology of vegetative genesis [1].

In cases where the active factor exceeds the adaptive capabilities of the cardiovascular system, a pathological process occurs, including both functional and structural disorders. The cardiovascular and respiratory systems, due to their “indicator” advantages, are given a priority role in assessing the adaptive capabilities of the whole organism [4,5].

## PURPOSE OF THE STUDY

To assess physical performance in adolescents with autonomic dysfunctions, depending on gender and a history of perinatal pathology.

## MATERIAL AND RESEARCH METHODS

We examined 243 adolescents 12-18 years old with clinically and laboratory-instrumental confirmed dysfunction of the autonomic nervous system - autonomic dystonia syndrome (ADS). The average age of the clinical manifestation of ADS in girls was 12.2 ± 1.8 years, in boys - 13.5 ± 2.1 years.

In the course of the study, groups of adolescents with ADS were formed depending on gender and a history of perinatal nervous system pathology (PNSP), group I consisted of 53 (21.8%) adolescent boys with PNSP, group II - 34 (14.0%) adolescent boys without PNSP, group III consisted of 107 (44.0%) adolescent girls with PNSP and group IV - 49 (20.2%) adolescent girls without PNSP. (Table 1). Among the surveyed adolescents with ADS, 69.5% lived in urban conditions, 30.5% - in the region.

**Table 1. Distribution of patients with ADS into groups depending on the presence of a history of PNSP.**

| Groups | city | | region | | total | |
|---|---|---|---|---|---|---|
| | abc. | % | abc | % | abc | % |
| teenage boys with PNSP (group I) | 38 | 22,5% | 15 | 20,3% | 53 | 21,8% |
| teenage boys without PNSP (group II) | 24 | 14,2% | 10 | 13,5% | 34 | 14,0% |
| teenage girls with PNSP (group III) | 76 | 45,0% | 31 | 41,9% | 107 | 44,0% |
| teenage girls with PNSP (group IV) | 31 | 18,3% | 18 | 24,3% | 49 | 20,2% |
| total | 169 | 100,0% | 74 | 100,0% | 243 | 100,0% |

*Note: ADS is a syndrome of vegetative dystonia.*
*PPNS-perinatal lesions of the nervous system.*

Depending on the type of initial vegetative tone (IVT), adolescents were divided into subgroups with vagotonic, sympathicotonic, mixed type of initial autonomic tone.

With normal stress index values and a combination of wago- and sympathicotonic signs, a group of children with a mixed type of IVT was identified. Among adolescents of group I, the sympatotonic type of IVT was more often detected in 54.7% of cases. In second place is the mixed type of IVT - in 28.3% of cases. In group II, eutonia was more often detected - in 55.9% of cases. In group III, more adolescents were with the vagotonic type of IVT - 52.3%, in group IV - almost half of the adolescents had eutonia - 42.9%, in second place in terms of occurrence was the vagotonic type of IVT - in 32.7% of cases (Table 2).

**Table 2 Distribution of adolescents depending on the initial vegetative tone**

| Groups | | Type of initial negative tone (INT) | | | |
|---|---|---|---|---|---|
| | | Wagotonic type | Sympathetic type | Mixed type | Eutonia |
| I group | n | 8 | 29 | 15 | 1 |
| (n=53) | % | 15,1% | 54,7% | 28,3% | 1,9% |
| II group | n | 2 | 8 | 5 | 19 |
| (n=34) | % | 5,9% | 23,5% | 14,7% | 55,9% |
| III group | n | 56 | 28 | 18 | 5 |
| (n=107) | % | 52,3% | 26,2% | 16,8% | 4,7% |
| IV group | n | 16 | 3 | 9 | 21 |
| (n=49) | % | 32,7% | 6,1% | 18,4% | 42,9% |

To assess the stable characteristics of vegetative indicators, we used diagnostic criteria for assessing the initial vegetative tone (IVT) A.M. Wayne et al. (1981), modified for childhood.

The assessment of physical performance was determined using the PWC 170 test. PWC 170 is the value of the power of physical activity in W or kgm / min, which a child can perform at a heart rate of 170 beats / min (1W =

4.12 kgm / min). All adolescents were determined by the maximum oxygen consumption (MOC) and the load power at a heart rate of 170 beats / min (PWC170) in a modified single 5-minute test according to I.A. Kornienko (1978): PWC170 = N * (170 - HR) / (HR - HR), where N is the load power, HR - HR at rest (min), HR - HR after exercise (min). The results obtained were compared with those of the PWC170 control group.

The maximum oxygen consumption was calculated using the formulas: IPC = 1.7 * PWC170 + 1240 (for boys); IPC = 2.2 * PWC 170 + 1070 (for girls). The results obtained were compared with the BMD indicators of children in the control group and were assessed according to the evaluation criteria (V.V. Vasil'eva et al., 1973; A.A. Guminsky, 1990) (Table 3).

**Table 3. Assessment of physical performance in terms of maximum oxygen consumption (MOC / kg).**

| MOC/kg | | GRADE |
|---|---|---|
| Boys | Girls | |
| 55-60 | 45-50 | Excellent |
| 50-54 | 40-44 | Good |
| 45-49 | 35-39 | Satisfactory |
| 44 and below | 34 and below | Unsatisfactory |

Statistical data processing was carried out using the STATISTICA 6.0 software package (StatSoft Inc., USA). For the studied parameters, the following indicators were determined: mean value (M), standard error of the mean (m); if necessary, the median (Me) and interquartile range (25% percentile and 75% percentile) of the trait are indicated. To compare the quantitative characteristics of two independent groups, a nonparametric method was used - the calculation of the Mann-Whitney U-test, for 3 or more groups - the Kruskal-Wallis ANOVA method. The assessment of qualitative parameters was carried out in absolute and relative values (%), to compare qualitative characteristics in two independent groups, the $\chi 2$ test was used, for small samples – Fisher's exact test, for multiple comparisons – Cochran's Q test. Differences with a 95% ($p < 0.05$) significance level were considered statistically significant.

**RESULTS**

In all adolescents, the indicators of physical performance were significantly lower in persons with vagotonic type of IVT (Table 4).

**Table 4.Physical performance in adolescents with various types of IVT.**

| Groups | Wagotonic type | Sympathetic type | Mixed type |
|---|---|---|---|
| I group | 285,0±3,9 | 315,1±3,2 | 300,1±3,2 |
| II group | 300,0±3,7 | 360,0±5,2 | 330,0±4,3 |
| III group | 180,1±2,8 | 215,1±4,3 | 197,0±3,1 |
| IV group | 168,1±2,9 | 200,1±3,2 | 184,1±3,2 |

In adolescents-boys in group I compared with group II, PWC 170 indicators in all subgroups were lower - 285.0 ± 3.9; 315.1 ± 3.2; 300.1 ± 3.2; 235.3 ± 4.4 versus 300.0 ± 3.7; 360.0 ± 5.2; 330.0 ± 4.3; 348.2 ± 4.3, respectively. (Figure 1).

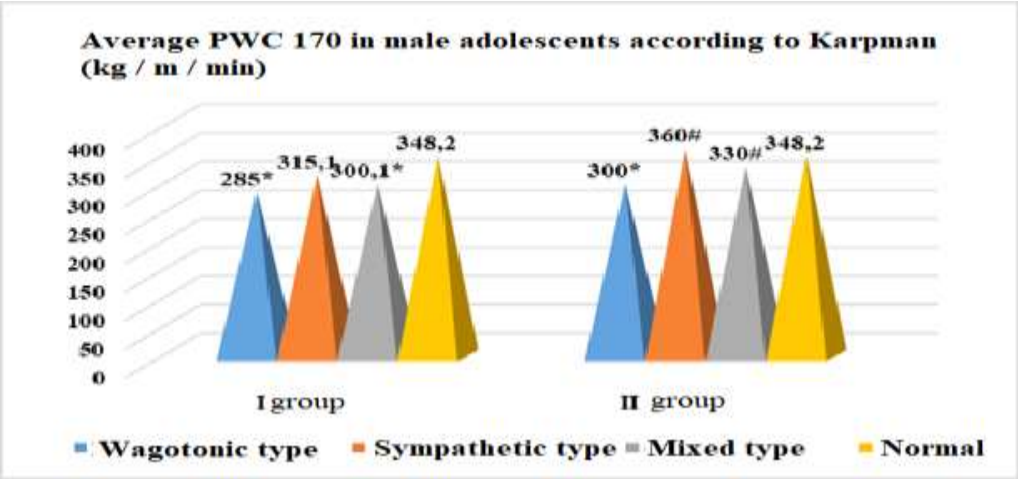


**Figure 1. Physical performance in adolescent boys with different types of IVT.**
*Note: * - p <0.001 statistical significance of the difference in indicators compared to the norm within one group; # - p <0.001 statistical significance of the difference in indicators compared to group I and group II/*

In groups III and IV, there was also a difference in PWC 170. Thus, adolescents with vagotonic, sympathetic, mixed types of IVT in group IV had better physical performance than adolescents in group III (Fig. 2.).

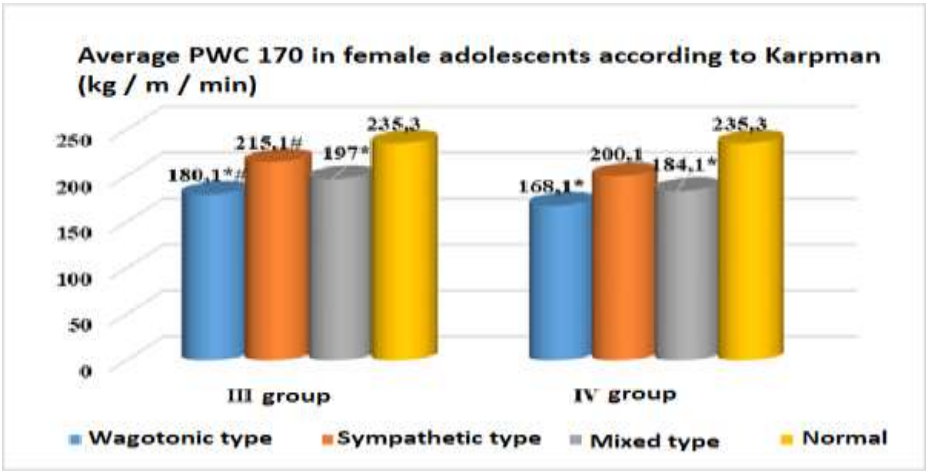


**Figure 2. Physical performance in adolescent girls with different types of IVT.**
*Note: * - p <0.001 statistical significance of the difference in indicators compared to the norm within one group; # - p <0.001 statistical significance of the difference in indicators compared to group III and group IV.*

## CONCLUSION

Thus, among adolescents, autonomic dysfunction occurs more often in adolescents with a history of perinatal pathology, especially in girls. In male adolescents with perinatal pathology and autonomic dysfunction, when studying the initial autonomic tone, sympathicotonia is more often detected, in girls with the same pathology, vagotonia. As for the study of physical performance in adolescents with autonomic dysfunctions, depending on gender and a history of perinatal pathology, children with perinatal pathology are less hardy than adolescents without a history of perinatal pathology.

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