HEALTHY LIFESTYLE. PREVENTION

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FEATURES OF INDICATORS OF 24-HOUR BLOOD PRESSURE MONITORING IN INTERNET-DEPENDENT ADOLESCENTS

DOI 10.25789/YMJ.2024.87.08

UDC 616-0727

The ever-increasing problem of Internet addiction (IA) in adolescents dictates the need to study its impact on the body, which is intensively developing in this age period, as the most susceptible to various adverse factors. At the same time, the relationship of Internet addiction with the pathology of the cardiovascular system has not yet been sufficiently investigated.

Purpose: In this regard, the purpose of our work was: to identify the main changes in the indicators of SMAD and their relationship with psycho-emotional state in children with Internet addiction.

Materials and methods: 69 children aged 11-18 years were examined with the help of 24-hour ambulatory blood pressure monitoring (ABPM) (TIR-NS-02s "Voskhod") on the basis of the Pediatric Department of the hospital in Krasnoyarsk. Internet addiction was identified by questionnaire using the Chen questionnaire (CIAS). The presence of psychological problems was determined by R. Goodman's questionnaire "Strengths and difficulties".

Results: As a result, children with unadapted Internet use have a tendency to increased variability in blood pressure indicators with an increase in hypotension indicators during the day and hypertension at night, which is a risk factor for the development of arterial hypertension (AH). At the same time, children with deviations in ABPM indicators were more likely than in the control group to have problems with behavior, hyperactivity and problems communicating with peers, as well as higher rates of personal anxiety with low levels of situational anxiety.

Conclusion: Thus, children with ID should be recommended to undergo ABPM in order to early identify established risk factors for the development of hypertension and its prevention with the mandatory use of psychotherapeutic techniques.

Keywords: daily blood pressure monitoring; adolescents; Internet addiction; blood pressure variability; R. Goodman questionnaire "Strengths and difficulties"

Introduction: Currently, the Internet is intensively introduced into all spheres of life. At the same time, the problem of Internet addiction (IA) among adolescents, as the least stable category of the population in the motivational-emotional sphere, is constantly growing [1, 6]. In this regard, studies on the impact of IA on health status are gaining momentum of particular relevance. The most attention is paid to the study of the risk of cardiovascular pathology development as the most frequent and serious problem in modern society [2-5, 7, 9, 14]. All kinds of ways and mechanisms contributing to the development of this pathology in Internet addiction are considered. Excessive time spent in front of a screen has been found to be associated with poor sleep [11] and cardiovascular risk factors such as high blood pressure, obesity, low High-density lipoproteins (HDL) cholesterol, poor stress regulation (high sympathetic arousal and cortisol dysregulation) and insulin resistance [12]. Anxiety-depressive symptoms and suicidal moods associated with poor sleep also contribute to the development of arterial hypertension (AH) [9]. In addition, early and prolonged exposure to violent and dynamic content that activates dopamine and reward pathways is associated with Attention deficit hyperactivity disorder, risk of antisocial behavior, and decreased prosocial behavior [12]. All these psycho-emotional abnormalities reduce the ability to cope with social problems, which increases the level of stress and, consequently, the degree of risk for the development of cardiovascular pathology [9]. Taking this into account, the majority of works are devoted to the study of autonomic regulation of heart rhythm in Internet addiction [2, 13].

However, despite the special significance of the problem of early detection of cardiovascular pathology in childhood, when it is still possible to prevent it, research on this topic is extremely insufficient. There are still no clear criteria for risk factors of AH development in children. Many authors pay attention to the important role of 24-hour ambulatory blood pressure monitoring (ABPM) in the preclinical detection of early signs of hypertension in children. Nevertheless, there are no studies devoted to the study of the parameters of ABPM in children with Internet addiction in the available literature [4, 7]. Taking this into account, the aim of our study was to identify the main changes in ABPM parameters and their relationship with psycho-emotional state in children with Internet addiction.

Materials and Methods: 69 children (37 boys and 32 girls) from 11 to 18 years of age (44 aged 11-14 years and 25 aged 15-18 years) were examined using a device of daily blood pressure monitoring - ABPM (MDP-NS-02s "Voskhod") on the basis of the Pediatric Department of the hospital in Krasnoyarsk. IA was determined using a self-completed questionnaire Chen (CIAS), according to the results of which all children were categorized into 3 groups:

1 - adaptive Internet users (AIU) with the sum of questionnaire scores up to 42 points (30 people / 17 boys, 13 girls),

2 - non-adaptive Internet users (NIU) with the sum of scores from 43 to 64 points (31 people / 18 boys, 13 girls),

3 - pathological Internet users (PIU) with a sum of 65 points or more (8 people / 3 boys, 5 girls).

However, given the small volume of group 3, it was decided to combine it with group 2:

1 - AIU (30 people / 17 boys, 13 girls),

2 - NIU (39 people / 21 boys, 18 girls).

In addition, all children were divided

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into 3 groups according to the sum of scores on Chen's questionnaire according to the value distribution:

1 - up to 25% inclusive (from 26 to 38 points on the CIAS scale) - 19 people / 10 boys, 9 girls;

2 - up to 75% inclusive (from 39 to 55 points on the CIAS scale) - 34 people / 19 boys, 15 girls;

3 - more than 75% (more than 55 points on the CIAS scale) - 16 people / 8 boys, 8 girls.

To identify psychological problems we used R. Goodman's questionnaire "Strengths and difficulties", as well as previously tested questionnaires with questions about the presence of sleep disorders, daytime sleepiness, asthenic syndrome (author Tereshchenko S.Yu, Professor, Head of the Clinical Department of Somatic and Mental Health of Children, "Federal Research Center" Krasnoyarsk Scientific Center of the Siberian Branch of the Russian Academy of Sciences " Scientific Research Institute of Medical Problems of the North, Krasnoyarsk, Russia), the Toronto Alexithymia Scale, Spielberger-Hanin questionnaire (to identify levels of personality and situational anxiety).

Statistical processing of the results was performed in the computer program "STATISTICA, 10" using the Mann-Whitney (M-W) criterion for comparison of two independent groups, Kraskell-Wallis (K-W) and median test (MT) for comparison of several independent groups, and Pearson Chi-square (PCS) for comparison of qualitative features. The 95% confidence interval was calculated using the «Exact Confidence Intervalor a Proportion calculator». Quantitative results are presented as Mean values with standard deviation and as medians with 25-75% interval; qualitative traits are presented as percentages with 95% confidence interval (CI). The results were considered reliable at a significance level of p<0.05; a trend toward reliable differences was defined at p<0.1.

Results and Discussion: The parameters of ABPM in children with Internet addiction are summarized in Table 1.

According to the obtained data (Table 1): average and maximum values of SBP and DBP in children with NIU do not differ from those in the control group, and minimum values tend to be lower. DNR of SBP does not differ from the control group, and DNR of DBP tends to increase. In addition, there is an increased variability of MeBP values, especially at night, and a tendency to increase the variability of DBP. Corresponding changes (decrease in minimum values, increased variability and lower decrease at night) are also observed with MeBP and PBP indices. Compensatory to this, there is an increase in PS values during the daytime.

The morning dynamics of BP indices in children with NIU had no significant differences from the control group. Hypertension indices for SBP also in our sample did not differ from the results of measurements in the control group, while hypotension indices for SBP were significantly elevated, especially in the morning and afternoon. For DBP, on the contrary, the hypertension indices tended to be higher in the afternoon, while the hypotension indices did not differ from the corresponding ones in the control group.

This is also reflected in the decrease in the mean integral indices of PBP.

When analyzing the results obtained when dividing the children into 3 groups according to the centile distribution according to the sum of CIAS scores, similar results were obtained (Table 2).

In addition, now for group 3 there is a tendency to increase the variability of SBP. Also markedly increased DNR of SBP and MeBP, but only in group 2, in group 3 it does not differ from the control group. At the same time, lower hypertension indices (HMI_SBP, HTI_SBP, HAI_SBP) are registered for group 2, especially at night. However, in the morning, they show a faster recovery (rise) of SBP, as reflected by an increase in SI_

Table 1

Parameters of ABPM in children with Internet addiction / Median (25%-27%)

ABPM parameters	AIU, n=30	NIU, n=39	p (M-W)
Min SBP	81 (75-88)	78 (74-85)	0.074
Variability DBP_	12.7 (10.8-14.5)	14 (12-15.4)	0.056
DNR DBP	12.8 (7.8-18.9)	16.5 (11.7-22.1)	0.078
Min_MeBP	64 (61-69)	61 (57-66)	0.061
Min_MeBP night	70 (64-74)	66 (60-70)	**0.041**
Variability MeBP	10.4 (9.1-11.8)	11.9 (10.1-13.3)	0.074
Variability MeBP night	8.5 (7.3-9.5)	10.1 (7.2-12.3)	**0.022**
Variability MeBP morning	9.5 (8.2-12.4)	12.2 (10.5-14.0)	0.071
Me PBP	46.9 (41.5-48.8)	43.4 (39.9-46.4)	0.072
Min_PBP morning	28 (23-32)	25 (20-28)	0.089
Me PS	76.4 (70.6-84.7)	83.1 (75.7-88)	0.055
Me PS day	82.1 (76.2-89.5)	88.5 (79.8-93.3)	**0.042**
HMI SBP morning	8.6 (0-24)	0 (0-10)	0.084
HypoMI SBP	5.3 (2.7-14.5)	10.5 (5.9-20)	**0.022**
HypoMI SBP day	7.1 (3.6-16.3)	12.3 (6.3-22.9)	**0.031**
HypoMI SBP_morning	0 (0-6.0)	7.7 (5.6-16.7)	**0.009**
HypoTI SBP	3.9 (1.5-10.4)	7.6 (4.1-20.1)	**0.029**
HypoTI SBP day	5.7 (2.8-13.8)	10.8 (6.1-23.4)	0.058
HypoTI SBP morning	0 (0-4.9)	4.6 (1.1-21.3)	**0.023**
HypoAI SBP	4.3 (1.2-15.8)	10.4 (4.7-34.3)	**0.030**
HypoAI SBP day	4.3 (1.2-14.2)	9.6 (4.6-33.7)	0.058
HypoAI SBP morning	0 (0-1.7)	1.1 (0-5.7)	**0.033**
NHypoAI SBP	0.2 (0.1-0.7)	0.4 (0.2-1.5)	**0.038**
NHypoAI SBP day	0.3 (0.1-1.0)	0.6 (0.3-2.1)	0.072
NHypoAI SBP morning	0 (0-0.3)	0.2 (0-0.9)	**0.031**
HAI DBP _day	2.4 (0.8-9.5)	6.1 (1.4-24.1)	0.082

Note: The table shows only data with a significance level of differences between the groups under study p<0.1. SBP - systolic blood pressure, mmHg, DBP - diastolic blood pressure, mmHg, MeBP - mean BP, mmHg, PBP - pulse BP, mmHg, PS - pulse rate, ppm, Me - mean-integral, Max - highest, Min - lowest, DNR - degree of nocturnal reduction, %, HMI - hypertension measurement index, %, HypoMI - hypotension measurement index, %, HypoTI - hypotension time index, %, HypoAI - hypotension area index mm Hg*hour, NHypoAI - normalized hypotension area index, mm Hg,

Table 2

ABPM parameters in children depending on centile distribution of the sum of CIAS scores / Mean - M (+/- standard deviation); Median - Me (25%-27%)

ABPM parameters *	AIU, n=18	NIU, n=34	PIU, n=16	p (K-W, MT)**
Me SBP_day , Me	116.2 (112-120.7)	114.1 (109.3-120.8)	113.2 (110-118.6)	0.088
Min_SBP , Me	82 (78-88)	78 (74-87)	77.5 (72.5-82.5)	0.088
Min_SBP_day, M	86.4 (76.9-95.9)	83.1 (73.3-92.8)	78 (71.8-84.2)	**0.038**
Variability SBP, M	12.1 (9.0-15.2)	13.2 (9.9-16.4)	14.1 (11.3-17.0)	0.089
Variability_SBP day, M	11.9 (8.5-15.3)	12.6 (9.7-15.5)	14.2 (11.5-17.0)	0.057
Variability SBP night, Me	9.8 (8.1-11.6)	9.6 (7.2-11.3)	11.1 (7.5-15.1)	0.083
DNR SBP, M	5.0 (-0.9-10.9)	9.0 (3.5-14.5)	4.6 (-2.0-11.3)	**0.017**
Min DBP night, Me	47.5 (44-50)	43 (40-47)	43.5 (38.5-49.5)	**0.030**
Variability DBP, M	12.8 (9.7-15.8)	13.6 (10.9-16.3)	14.6 (11.6-17.6)	0.081
Variability_DBP day, M	11.2 (8.9-12.9)	12.3 (10.2-14.7)	14.3 (11.6-16.0)	0.062
Min_MeBP, Me	64 (62-69)	61 (57-65)	62 (58-66.5)	**0.040**
Min_MeBP morning, Me	73 (69-76)	68 (63-75)	68 (63-74.5)	0.060
Variability MeBP, Me	10.1 (8.4-11.5)	11.3 (9.9-13.2)	12.3 (10.6-13.5)	0.052
Variability MeBP morning, M	9.5 (5.8-13.1)	12.1 (7.4-16.8)	13.1 (8.8-17.5)	0.090
DNR MeBP, M	6.9 (1.4-12.3)	10.4 (4.9-15.8)	7.4 (1.4-13.5)	0.072
Me PBP, Me	47.5 (43.0-48.8)	43.8 (40.2-48.1)	43.3 (40.2-44.4)	**0.023**
Min_PBP, M	20.8 (17.1-24.6)	21.0 (17.7-24.3)	18.3 (15.3-21.3)	**0.029**
Min_PBP day, M	21.6 (17.2-26.1)	22.4 (17.9-26.8)	18.6 (15.6-21.6)	**0.008**
DNR PBP, M	-6.1 (-16.1-4.0)	-2.5 (-9.4-4.5)	-11.8 (-23.1-0.5)	**0.015**
Me_PS, Me	74.5 (68.2-87.3)	80.3 (74.3-65.3)	83.3 (79-88.5)	**0.047**
Me_PS_morning, Me	68.9 (64.6-87.4)	76.7 (67.8-84.0)	82.3 (78.3-90.8)	**0.032**
Min PS, Me	53 (50-61)	57 (50-63)	60 (55.5-64.5)	**0.022**
Min PS night, Me	53 (50-61)	57 (50-63)	60 (55.5-65.5)	**0.022**
Min PS morning, Me	54 (52-61)	58 (51-66)	63.5 (59-68.5)	**0.047**
MMR PS, Me	48 (34-69)	53.5 (40-73)	42 (34.5-51.5)	0.083
HTI_SBP_night, Me	11 (1.5-22.9)	3.3 (0-10.4)	13.5 (0.5-35.9)	0.059
HAI SBP night, Me	4.8 (0.1-16.0)	1.2 (0-3.8)	4.3 (0-17.7)	**0.020**
NHAI SBP night, Me	0.4 (0.0-1.7)	0.1 (0.0-0.4)	0.7 (0.0-3.7)	**0.020**
HypoMI SBP, M	9.8 (-2.2-21.7)	15.2 (-1.7-32.1)	16.3 (4.6-27.9)	**0.029**
HypoMI SBP day, M	12.1 (-3.1-27.3)	18.0 (-2.5-38.5)	19.7 (5.6-33.9)	**0.037**
HypoMI SBP morning, Me	0 (0-5.3)	5.6 (0-16.7)	9.7 (5.9-16.7)	**0.009**
HypoTI SBP, M	7.9 (-3.5-19.3)	13.2 (-2.5-28.8)	12.9 (1.4-24.3)	0.061
HypoTI SBP day, M	11.6 (-5.6-28.8)	17.0 (-3.3-37.2)	17.7 (3.2-32.2)	0.064
HypoTI SBP morning, M	4.2 (-6.8-15.1)	12.3 (-5.2-29.8)	8.4 (-1.3-18.1)	0.060
HypoAI SBP, M	10.7 (-6.8-28.2)	19.9 (-6.6-46.4)	21.1 (-0.3-42.5)	**0.029**
HypoAI SBP day, M	10.3 (-7.1-27.7)	18.2 (-6.8-43.3)	20.6 (-0.3-41.6)	**0.035**
HypoAI SBP morning, M	1.8 (-3.2-6.8)	3.7 (-1.3-8.6)	2.8 (-1.4-6.9)	0.060
NHypoAI SBP, M	0.5 (-0.3-1.2)	0.8 (-0.3-1.9)	0.9 (-0.0-1.8)	**0.038**
NHypoAI SBP day, M	0.7 (-0.4-1.9)	1.2 (-0.4-2.7)	1.3 (0.0-2.6)	**0.044**
NHypoAI SBP morning, M	0.3 (-0.6-1.1)	0.6 (-0.2-1.4)	0.5 (-0.2-1.2)	0.061
HTI DBP, Me	8.0 (5.7-13.2)	10.4 (4.1-22)	13.4 (6.4-21.8)	0.057
HypoMI DBP morning, Me	5.3 (0-8.3)	22.2 (0-30.8)	12.2 (0-17.6)	0.088

Note: * - for each parameter the mean (M) or median (Me) is presented; ** - for the mean value the p for the Kraskell-Wallis criterion (K-W) is presented, for the median - p for the median test (MT). SBP - systolic blood pressure, mm Hg, DBP - diastolic BP, mm Hg, MeBP - mean BP, mmHg, PBP - pulse BP, mmHg, PS - pulse rate, ppm, Me - mean-integral, Max - highest, Min - lowest, DNR - degree of nocturnal reduction, %,, MMR - the magnitude of the morning rise, mm Hg, HTI - hypertension time index, %, HAI - hypertension area index, mm Hg*h, NHAI - normalized hypertension area index, mm Hg, HypoMI - hypotension measurement index, %, HypoTI - hypotension time index, %, HypoAI - hypotension area index mm Hg*hour, NHypoAI - normalized hypotension area index, mm Hg, SBP, compared to the other groups. In this respect, group 2 appears to be more adaptive. This may be due to the fact that they do not have IA yet, and they use the Internet as a way to relieve stress and solve psychological problems, which may be deprived of children from the control group, who use the Internet to a lesser extent and experience or suppress stress in themselves more, which is manifested in sleep disturbance and various vegetative symptoms.

As for hypotension indices, they were significantly higher (mainly in the afternoon and morning) in both group 2 and group 3, compared to the control group.

When analyzing the frequency of occurrence of deviations from normal values of ABPM in children with NIU (Table 3), compared to the control group, instability of BP is noted. They have more frequent deviations of SBP, a tendency to increased variability of DBP during the daytime with an increase in HTI of DBP, and an increased reduction of DBP at night (Over-Dipper).

When analyzing the frequency of deviations from normal values of ABPM parameters in children in the groups distributed by centile intervals (Table 4), children in Groups 2 and 3 also showed a marked tendency for a more frequent increase in daytime DBP variability. In addition, they also showed an increase in nighttime SBP variability. And as noted above, group 2 has a significantly less frequent increase in nighttime HTI SBP and DBP.

Thus, children with NIU and PIU are prone to increased variability of BP parameters with an increase in hypotension during the day and hypertension at night. Increased BP variability is considered as a risk factor for the development of arterial hypertension (AH) [3, 10]. The findings are in line with the expected results, since literature sources and our previous studies suggest that sleep disturbance in children with Internet addiction (due to decreased melatonin production under the influence of blue radiation from gadget screens) is accompanied by insufficient BP reduction at night and thus contributes to an increased risk of hypertension [11, 12]. However, although in our study in children in group 3 (with high CIAS scores) there is a predominance of elevated HTI of SBP and DBP at night, but the same trend is noted in the control group. This is probably due to the fact, that nowadays almost all children spend time before bedtime at gadget screens, which is confirmed by the same frequency (60-70%) of insufficient nocturnal reduction of SBP values in all children (Table 3). This may also be due to the fact, that they tend to be hypotensive during the day. In our study, this can also be explained by the fact that the children were hospitalized and spent most of the day in a state of hypodynamia. In addition, the control group itself consisted of children suffering from somatic pathology (bronchial asthma, obstructive bronchitis, allergic rhinitis, headaches). Nevertheless, the prevalence of children with lowered DNR SBP revealed by us has an unfavorable value, as according to the results of many researchers it is a serious risk factor for the development of cardiovascular pathology. Thus, children in the group of "non-dippers", compared to "dippers", were found to have a higher concentration of total cholesterol in blood, significantly lower mean values of left ventricular end-diastolic dimension, and more frequent detection of protein in urine [4].

Also unfavorable prognostic significance in terms of AH development is the increase in HTI BP at night, even with normal values of other BP parameters [3]. According to O.V. Kozhevnikova et al. in 21% of cases in such children hypotension was even noted during the daytime [7], which is also observed in our study (Tables 1-2). This situation was observed by the authors in children with chronic otolaryngological pathology [7], which is also characteristic of our sample of children.

On the other hand, there are studies that confirm a disorder of autonomic

Table 3

Frequency of occurrence of deviations from the normal values of ABPM in children with Internet addiction, % (95%-CI)

ABPM parameters	AIU, n=30	NIU, n=39	P
Me SBP			
normal	100 (88.8-100)	87.2 (73.2-94.3)	0.042
low	0	5.1 (1.6-16.9)	0.209
elevated	0	7.7 (2.8-20.4)	0.120
Variability SBP			
normal	83.3 (66.3-92.5)	71.8 (56.1-83.4)	0.262
elevated	16.7 (7.5-33.7)	28.2 (16.6-43.9)	0.262
DNR SBP			
Dipper	13.3 (5.5-29.8)	25.6 (14.6-41.2)	0.208
Non-dipper	73.3 (55.4-85.8)	64.1 (48.3-77.3)	0.416
Over-Dipper	0	2.6 (0.6-13.2)	0.374
Night-Peaker	13.3 (5.5-29.8)	7.7 (2.8-20.4)	0.445
Variability DBP			
normal	43.3 (27.3-60.9)	30.8 (18.6-46.5)	0.284
elevated	56.7 (39.1-72.7)	69.2 (53.5-81.4)	0.284
Variability DBP day			
normal	70.0 (52.0-83.3)	48.7 (33.8-63.8)	0.076
elevated	30.0 (16.7-48.0)	51.3 (36.1-66.2)	0.076
Variability DBP night			
normal	56.7 (39.1-72.7)	41.0 (27.0-56.7)	0.196
elevated	43.3 (27.3-60.9)	59.0 (43.3-73)	0.196
DNR DBP			
Dipper	60.0 (42.2-75.5)	53.8 (38.5-68.5)	0.607
Non-dipper	23.3 (11.9-41.1)	17.9 (9.1-32.8)	0.580
Over-Dipper	6.7 (2.0-21.4)	25.6 (14.6-41.2)	0.040
Night-Peaker	10.0 (3.6-25.8)	2.6 (0.6-13.2)	0.193
HTI_DBP_day			
normal	93.3 (78.6-98)	76.9 (61.5-87.3)	0.065
elevated	6.7 (2.0-21.4)	23.1 (12.7-38.5)	0.065

regulation of the cardiovascular system in children with Internet addiction [2, 13, 14], which may also be associated with increased BP variability and a tendency to hypotension in our study. In children with lability of the autonomic nervous system, as a rule, there is also lability of the emotional sphere, which is also characteristic of children with Internet addiction [6, 8] and through dysregulation of the autonomic nervous system (ANS) can contribute to the development of increased BP variability.

Also of interest is the fact that children at risk of Internet addiction (group 2), compared to other children, are more likely to have normal BP values, in particular, they do not tend to be hypertensive at night. Perhaps, as mentioned above, they adapt more easily to stress and experience problems using the Internet as a way of psychotherapy, unlike the control group (with low CIAS scores), who may be more reserved and suppress emotions in themselves, or the group with obvious Internet addiction, who may have more psychological problems.

Some explanation for this situation can be found in the study of heart rate variability (HRV) in adolescents with different degrees of Internet addiction [2], according to which in children with severe withdrawal symptoms during withdrawal from the Internet, sympathicotonia and a decrease in vagus regulation of heart

Table 4

Frequency of occurrence of deviations from the normal values of ABPM in children with Internet addiction, %

ABPM parameters	AIU, n=18	NIU, n=34	PIU, n=16	p (PCS)
Variability SBP				
normal	83.3	79.4	62.5	0.306
elevated	16.7	20.6	37.5	
Variability SBP day				
normal	88.9	85.3	75	0.519
elevated	11.1	14.7	25	
Variability SBP night				
normal	88.9	97.1	68.8	0.015
elevated	11.1	2.9	31.3	
Variability DBP day				
normal	77.8	55.9	37.5	0.058
elevated	22.2	44.1	62.5	
Variability DBP night				
normal	55.6	47.1	37.5	0.575
elevated	44.4	52.9	62.5	
DNR DBP				
Dipper	61.1	55.9	50	0.224
Non-dipper	16.7	23.5	18.8	
Over-Dipper	5.6	20.6	25	
Night-Peaker	16.7	0	6.3	
HTI_SBP_night				
normal	47.4	73.5	37.5	0.030
elevated	52.6	26.5	62.5	
HTI_DBP_night				
normal	26.3	47.1	25	0.182
elevated	73.7	52.9	75	

Table 5

Frequency of psychological problems in children with ABPM abnormalities characteristic of Internet addiction, % (95%-CI)

Problems	Variability DBP		HTI SBP night		HTI DBP night	
	normal	elevated	normal	elevated	normal	elevated
Goodman Scale:	N=22	N=32	N=31	N=23	N=20	N=34
Total score, deviance	9.1 (2.8-28)	21.9 (11.1-38.9)	16.1 (7.2-32.8)	17.4 (7.1-37.4)	20 (8.2-41.9)	14.7 (6.6-30.3)
Prosocial scale, deviance	9.1 (2.8-28)	0 (0-10.6)*	6.5 (2.0-20.8)	0 (0.1-14.2)	5 (1.2-23.8)	2.9 (0.7-14.9)
Behavior problems	0 (0.1-14.8)	12.5 (5.1-28.2)*	6.5 (2.0-20.8)	6.7 (2.7-27)	10 (3-30.4)	5.9 (1.8-19.2)
Emotional scale, deviation	9.1 (2.8-28)	12.5 (5.1-28.2)	12.9 (5.3-29.0)	6.7 (2.7-27)	15 (5.4-36.3)	8.8 (3.2-23.1)
Hyperactivity	4.5 (1.1-21.9)	25.0 (13.3-42.3)**	19.4 (9.3-36.4)	13.0 (4.7-32.4)	25.0 (11.3-47.2)	11.8 (4.8-26.7)
Problems communicating with peers	4.5 (1.1-21.9)	12.5 (5.1-28.2)	3.2 (0.8-16.2)	17.4 (7.1-37.4)*	5 (1.2-23.8)	11.8 (4.8-26.7)
Alexithymia	54.5 (34.5-73.2)	46.3 (32.0-61.3)	48.6 (32.9-64.5)	50.0 (32.5-67.5)	52.4 (32.2-71.8)	47.6 (33.3-62.3)
Situational anxiety	40.9 (23.2-61.5)	31.4 (18.6-48.1)	55.2 (37.4-71.7)	14.3 (5.8-31.7)**	45.0 (25.7-66)	29.7 (17.5-45.9)
Personality anxiety	77.3 (56.3-89.8)	88.6 (73.9-95.3)	82.8 (65.3-92.3)	85.7 (68.3-94.2)	75 (52.8-88.7)	89.2 (75.2-95.6)
Asthenic syndrome	13.6 (5.0-33.6)	16.7 (8-32)	15.6 (7-31.9)	15.4 (6.3-33.7)	19.0 (7.8-40.3)	13.2 (5.9-27.4)
Daytime sleepiness	9.0 (2.8-28)	20.0 (10.1-36)	18.8 (9-35.5)	12.0 (4.4-30.2)	14.3 (5.2-34.9)	16.7 (8-32)
Insomnia	5.0 (1.2-23.8)	24.2 (12.9-41.2)*	17.2 (7.7-34.7)	16.7 (6.8-36.1)	31.6 (15.4-54.3)	8.8 (3.2-23.1)

* $p<0.1$; ** $p<0.05$.

Table 6

Frequency of psychological problems in children with inadequate nocturnal lowering of SBP, % (95%-CI)

Goodman Scale	Dipper N=12	Non-dipper N=37	p
Total score, deviation	25.0 (9.1-53.8)	13.5 (6.0-28.1)	0.349
Prosocial scale, deviance	0 (0.2-24.7)	5.4 (1.7-17.7)	0.411
Behavior problems	8.3 (1.9-36)	8.1 (2.9-21.4)	0.983
Emotional scale, deviance	16.7 (5.0-45.4)	10.8 (4.4-24.8)	0.588
Hyperactivity	16.7 (5.0-45.4)	16.2 (7.7-31.3)	0.968
Problems communicating with peers	0 (0.2-24.7)	10.8 (4.4-24.8)	0.235
Alexithymia	41.7 (19.2-68.4)	54.5 (40.0-68.3)	0.441
Situational anxiety	50.0 (25.1-74.9)	33.3 (20.6-49.1)	0.299
Personality anxiety	83.3 (54.6-95)	86.8 (72.6-94.1)	0.762

rhythm were established, while in individuals with minimal withdrawal symptoms, total HRV and vagus nerve activity remained higher and their temporal assessment effective. Other researchers also testify to the predominance of sympathicotonia in Internet addiction [13].

Thus, the propensity to develop AH in children with Internet addiction can be explained by the presence of common psychological risk factors, such as stress exposure and anxiety-depressive disorders [5, 8, 9].

Thus, when analyzing psychological deviations in children with insufficient nocturnal BP reduction, no reliable differences (possibly due to small group sizes) were revealed. However, some tendency to more frequent problems in communication with peers and less pronounced situational anxiety against the background of high personality anxiety and frequent alexithymia was also noted.

Conclusions:

1) Children with Internet addiction have increased variability of SBP and DBP with predominance of hypotension (HypoMI and HypoTI) during the day and hypertension at night (HTI), which is a risk factor for AH development

2) More than half of children in both the group with Internet addiction and the control group have insufficient degree of nocturnal reduction of SBP "non-dippers", which is also a risk factor for the development of AH.

3) Children at risk of developing Internet addiction, but without obvious Internet addiction, do not show an increase in nighttime HTI, which is characteristic of the control group and the group with Internet addiction, possibly due to fewer psychological problems, as well as the ability to relieve tension on the Internet, while children without Internet addiction may be more restrained, responsible and disciplined, which affects their psychological state

4) In children with deviations of ABPM indicators there are more frequent behavioral problems, hyperactivity and problems of communication with peers, as well as lower indicators of situational anxiety with high indicators of personality anxiety, which, according to our previous studies, as well as studies by other authors, is also characteristic of individuals with Internet addiction [6].

5) Thus, we can conclude that the psychological features and deviations present in children with Internet addiction through the ANS regulation disorder affect systemic hemodynamics and lead to the development of AH. In addition, sleep disorders in children with Internet addiction due to insufficient melatonin production under the influence of blue radiation from gadget monitors contribute to this. This is confirmed by the decrease in the degree of nocturnal decrease in SBP.

6) Thus, it is necessary to recommend children not to use gadgets before bedtime with obligatory control by parents; all children with obvious Internet addiction should be recommended to perform ABPM for early detection of established risk factors for the development of AH and its prevention with an obligatory psychotherapeutic component.

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DOI 10.25789/YMJ.2024.87.09

UDC 796.612.2

ASSESSMENT OF THE BODY RESISTANCE OF ATHLETES FROM YAKUTIA TO HYPOXIA

The article reflects the assessment of the body resistance of students of the «North-Eastern Federal University named after M.K. Ammosov», living in the Far North, to hypoxic conditions. 146 people took part in the study – 119 boys and 27 girls. Of these, the study group consisted of 74 student – athletes (59 boys, 15 girls), the control group consisted of 72 students engaged in physical education according to the general program of the University (60 boys, 12 girls). The average age of the surveyed was 21± 2,5 years. To identify the assessment of the body's resistance to hypoxia in Yakutia athletes, the following functional tests were conducted: the Stange test (breath holding on inhalation) and the Genchi test (breath holding on exhalation). The obtained results of the study allowed us to see the prevailing excellent criterion (assessment "excellent") in athletes and the average criterion (assessment "good") in the control group, the results with an unsatisfactory criterion (assessment "unsatisfactory") were less. The conducted assessment shows a positive level of non-specific adaptive capabilities of the respiratory system in the studied students. The functional resistance of the respiratory system to hypoxia in young men was significantly higher than in girls.

Keywords: athletes of Yakutia, students, hypoxia, Stange's test, Genchi test

Introduction: The physiological state of the human body is determined by oxygen consumption. Oxygen is necessary for breathing, saturation of cells and tissues of the body with oxygen, oxidation of proteins, fats, carbohydrates, amino acids, as well as for many other biochemical processes. Oxygen enters the tissues and cells of the body through the respiratory and cardiovascular systems. If these body systems fail to function, hypoxia may develop. During diagnostics of the human respiratory system, the volume of the lungs, the rhythm of breathing, its depth are determined, and standard methods of functional tests are used to determine resistance and adaptation to hypoxia. Functional breath-holding tests, such as the Stange test (breath-holding on inhalation) and the Genchi test (breath-holding on exhalation), can reveal hidden disorders in the body's functioning that cannot always be determined by standard methods. These tests help assess the body's resistance to hypoxia and endurance. Such tests are easy to perform, so you can test yourself and assess whether there are any problems with the respiratory system.

In the works of a number of authors it has been noted that the longer the breath-holding time, the higher the adaptive capacity of the respiratory and cardiovascular systems to hypoxia and high functional capabilities of the body [1, 3, 7]. In case of dysfunction of the oxygen-transport system of the body, for example, in case of iron deficiency anemia, the duration of breath-holding is reduced [8, 9].

The aim of the study. To assess the resistance of the body of students of Yakutia to hypoxia depending on physical activity on the possibility of holding the breath on inhalation and exhalation.

Materials and methods of the study: 146 students of NEFU named after M.K. Ammosov were examined. Of these, the study group consisted of 74 athletes (59 boys, 15 girls), the control group consisted of 72 students involved in physical education according to the general program of the university (60 boys, 12 girls). The average age of the examined was 21±2.5 years.

The athletes were involved in the following sports: track and field - 20 people, mas-wrestling - 34 people, national jumping - 8 people, shooting - 5 people, freestyle wrestling - 7 people.

The following functional tests were used in the study to determine the body's sensitivity to oxygen deficiency:

Stange test. Method of performance: the subject inhales, then exhales, and again takes a deep breath and holds his breath for the maximum possible time. The time of breath holding is recorded. The norm for men = 50–60 sec; the norm for athletes = 65–75 sec and more; the norm for women = 35–45 sec; the norm for female athletes = 45–55 sec. Evaluation of results: “excellent” – for men from 60 sec, for women from 50 sec; “good” – for men from 50 to 59 sec, for women from 40 to 49 sec; “satisfactory” – for men from 35 to 49 sec, for women from 30 to 39 sec; “unsatisfactory” – for men less than 35 sec, for women less than 30 sec.

Genchi test. Method of execution: it is carried out similarly to the Stange test,

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