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Y.V. Karulina , T.I. Shevtsova
Bogomolets National Medical University, Kyiv, Ukraine

Treatment of motility disorders of the upper digestive tract in children with autonomic dysfunction

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Abstract. Background. Recently, there has been an increase in the prevalence of the autonomic nervous system (ANS) dysfunction and, against this background, motility disorders of the upper digestive tract (UDT), which, in turn, is the basis for the formation of chronic pathology of the digestive organs in children. The purpose was to improve the treatment of children with ANS dysfunction by studying the type of motility disorders of the UDT and prescribing therapy schemes depending on the type of disorders. **Materials and methods.** The article presents the results of clinical and anamnestic, laboratory, instrumental and psychological research of 109 children aged 6–16 years with autonomic dysfunction. **Results.** All surveyed children were divided into two representative groups: group I (main one, $n = 87$) — patients with autonomic dysfunction and impaired motility of the UDT who by type of motor function were divided into two subgroups: IA — with the acceleration of this function ($n = 18$) and IB — with its slowdown ($n = 69$); group II (comparison one, $n = 22$) — children with autonomic dysfunction without motility disorders of the UDT. In order to treat patients in subgroup IA, they, in turn, were divided into two therapeutic subgroups: IA1 — only basic therapy for autonomic dysfunction, and IA2 — in addition to basic therapy for autonomic dysfunction, correction of motility disorders of the UDT was performed. Patients of subgroup IB were also divided into two subgroups: IB1 — only basic therapy for autonomic dysfunction, and IB2 — in addition to basic therapy for autonomic dysfunction, correction of motility disorders of the UDT was conducted. The effectiveness of treatment for autonomic dysfunction syndrome has been proven, taking into account the type of motility disorders of the UDT. Different treatment regimens were proposed for children with ANS dysfunction without disorders and with the presence of motility disorders. The use in the comprehensive treatment of children with autonomic dysfunction syndrome of drugs that affect the motor function of the upper alimentary canal significantly increases its effectiveness during treatment for 30 days (89.0 versus 57.0 % when motor function slows down). **Conclusions.** The effectiveness of the comprehensive treatment for autonomic dysfunction has been proven, taking into account the type of motility disorders of the UDT. It reliably reduces the risk of recurrence of clinical manifestations of gastrointestinal pathology in children.

Keywords: autonomic dysfunction; motor function; children

Introduction

The syndrome of autonomic dysfunction is one of the most common pathologies among the child population, with a frequency of 30 %. Over time, it can become the basis for the development of hypertension, ischemic heart disease, bronchial asthma, frequent respiratory infections. In 33.3 % of children, autonomic disturbances persist for many years despite treatment, and in 17–20 % of children, they may progress, causing the development of severe somatic diseases [1, 8].

Motility disorders of the digestive tract are observed in more than 30 % of children with gastrointestinal pathology [2].

The frequent absence of organic causes at the base of motility disorders of the digestive tract indicates their dysregulatory nature. Most researchers tend to think that disturbances in autonomic regulation of the sphincter activity play an important role in the origin of motor-evacuation disorders of the digestive tract in children [3, 12].



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Для кореспонденції: Каруліна Юлія Віталіївна, кандидат медичних наук, доцент кафедри педіатрії № 2, Національний медичний університет імені О.О. Богомольця, бульв. Т. Шевченка, 13, м. Київ, 02000, Україна; e-mail: karulina@ukr.net

For correspondence: Y.V. Karulina, PhD, Associate Professor at the Department of Pediatrics 2, Bogomolets National Medical University, T. Shevchenko boulevard, 13, Kyiv, Ukraine; e-mail: karulina@ukr.net

Full list of authors' information is available at the end of the article.

Environmental factors, namely air pollution, is significant in the development of these pathological conditions in children [13, 14].

One of the important factors in the occurrence of motor-evacuation disorders of the upper digestive tract are disorders of the nervous system in the form of the autonomic nervous system (ANS) dysfunction. Recently, children have been experiencing significant psycho-emotional overload, which in turn causes earlier onset of disorders of the autonomic nervous system function [11].

Arising against the background of disorders from the autonomic nervous system, disorders of the motor function of the digestive tract contribute to a longer and more severe course of gastrointestinal diseases. Therefore, considering the state of the autonomic nervous system in these children is of great importance in terms of developing effective treatment schemes for this pathology.

The purpose: to improve the treatment of children with autonomic dysfunction syndrome by studying the type of motility disorders of the upper digestive tract and prescribing therapy schemes depending on them.

Materials and methods

To achieve the set goal and solve the tasks, 109 children aged 6–16 years with autonomic dysfunction were examined. Clinical and anamnestic, laboratory (common blood and urine tests, feces analysis for helminth eggs and the presence of *H.pylori* antigens), instrumental (fibroesophagogastroduodenoscopy (FEGDS), ultrasound examination of the stomach with filling, study of autonomic homeostasis by cardiointervalography) examinations, psychological study methods (determining the levels of situational and personal anxiety using the Spielberger-Hanin test), and statistical processing of the results were used.

Results

Based on the results of clinical and instrumental examination, 109 patients were divided into two representative groups. The main group (I) included 87 children with ANS dysfunction and motility disorders of the UDT. The comparison group (II) consisted of 22 children with ANS dysfunction without motility disorders of the digestive tract. Data on the distribution of the examined patients by age and gender are presented in Table 1.

We did not find a statistically significant difference between the groups either by age distribution ($p = 0.46$) or by gender distribution ($p = 0.81$).

Following our examination scheme, children under observation underwent analysis of complaints, life and disease

history, and objective examination using general clinical, instrumental, and laboratory research methods. We studied the following information: age, gender, the course of pregnancy and childbirth in the mother, diseases in early childhood, the presence of chronic and functional digestive pathology in the parents, autonomic dysfunction in the parents, of the child, the nature of nutrition in infancy and school age, the presence of food allergies and the impact of psychogenic factors, duration of complaints, frequency of exacerbations, results of previous examinations.

To evaluate the clinical course of autonomic dysfunction and motility disorders of the UDT, we studied the symptoms of diseases, taking into account physical data, results of common blood and urine tests, biochemical blood tests, feces analysis for helminth eggs, electrocardiography data, consultations with doctors (otolaryngologist, neurologist, ophthalmologist, endocrinologist), and abdominal ultrasound.

The state of the gastric and duodenal mucosa and the presence of motility disorders in the form of reflux were assessed by us based on FEGDS data, conducted using Richard Wolf 2163 (Germany) and Olympus CLE 10 (Japan) fibroscopes.

Based on the results of the ultrasound examination of the stomach with filling, the type of motility disorders of the upper digestive tract was determined. In 63.3 % of children, a slowdown of motor function was detected, in 16.5 %, its acceleration, and 20.2 % of patients had normal motor function of the upper digestive tract.

During FEGDS, motility disorders of the UDT in the form of duodenogastric reflux were found in 18 (16.5 %) children with ANS dysfunction and complaints of abdominal pain and dyspeptic symptoms. These children, according to the ultrasound of the stomach with filling, had an accelerated evacuation function of the UDT. During the examination for *H.pylori* infection using the stool test, a positive result was obtained in 31.1 % of cases in the main group and in 13.6 % in the comparison one (Table 2). We did not found a connection between *H.pylori* infection and the occurrence of motility disorders of the UDT in children with ANS dysfunction.

Based on the results of the clinical and instrumental examination, children in the main group (I) were divided into two subgroups: IA — 18 (16.5 %) patients with autonomic dysfunction syndrome and accelerated motor function of the UDT; IB — 69 (63.3 %) participants with autonomic dysfunction syndrome and slowed motor function of the UDT.

All children underwent a study of autonomic regulation of heart rhythm using cardiointervalography with the Car-

Table 1. Distribution of examined patients by age and gender

Group	Age				p	Gender				p
	6–10		11–16			Girls		Boys		
	n	%	n	%		n	%	n	%	
Main, n = 87	32	36.8	55	63.2	0.46	44	50.6	43	49.4	0.81
Comparison, n = 22	6	27.3	16	72.7		10	45.4	12	54.5	

Note (here and in Table 2): comparisons were made using Fisher’s exact test.

diospectr device, as well as assessment of reactive (situational) and personal anxiety using the Spielberger-Hanin test.

To conduct treatment, children of the IA subgroup were divided into two therapeutic subgroups: IA1 — only basic therapy for ANS dysfunction, and IA2 — correction of accelerated motor function of the UDT in addition to basic therapy for ANS dysfunction. Patients of the IB subgroup with ANS dysfunction and slowed motor function of the UDT were also divided into two therapeutic subgroups: IB1 — only basic therapy for ANS dysfunction, and IB2 — correction for slowed motor function of the UDT in addition to basic therapy for ANS dysfunction (Table 3).

We assessed the clinical effect of treatment and its impact on the state of autonomic homeostasis. The effectiveness of the treatment was evaluated after a 30-day therapy course based on the degree of regression of the main symptoms of ANS dysfunction (headache, increased fatigue, pain in the heart area, emotional lability) and motility disorders of the UDT (abdominal pain, nausea, belching, appetite disorders).

The analysis of the symptoms of digestive disorders after a 30-day course of treatment demonstrated that abdominal pain persisted in 22.2 % of patients in subgroup IA2 and

55.5 % in subgroup IA1 ($p > 0.05$), as well as in 14.7 % of children in subgroup IB2 and 62.8 % in subgroup IB1 (the difference is statistically significant, $p < 0.05$). Also, in subgroup IB2, dyspeptic symptoms decreased significantly ($p < 0.05$): belching persisted in only 5.9 % of cases, nausea — in 8.8 % (Table 4).

The analysis of the dynamics of ANS dysfunction symptoms after a 30-day treatment showed that complaints of headache persisted in 22.2 % of patients in subgroup IA2, 55.5 % in subgroup IA1 ($p > 0.05$), 5.8 % in subgroup IB2, and in 34.2 % in subgroup IB1 ($p < 0.05$). Also, in most children of subgroups IA2 and IB2, such symptoms as pain in the heart area, increased fatigue, and emotional lability disappeared (Table 5).

In subgroups IA2 and IB2, the treatment led to a significant reduction in the median on the overall symptom scale after 30 days of treatment: 6 (4–7) versus 3 (2–4) and 4 (3–5) versus 3 (2–3), respectively ($p < 0.001$), for both comparisons.

When evaluating the treatment after 12 months, it was found that relapses of clinical manifestations of ANS dysfunction were more frequent in subgroups IA1 and IB1 (30.0

Table 2. *H. pylori* status in children of the main and the comparison groups

<i>H. pylori</i> status	Main (n = 87)		Comparison (n = 22)		p
	n	%	n	%	
Positive	27	31.1	3	13.6	0.12
Negative	60	68.9	19	86.4	

Table 3. *Treatment for motility disorders of the UDT in children with autonomic dysfunction syndrome*

Subgroup IA (n = 18)		Subgroup IB (n = 69)	
Subgroup IA1	Subgroup IA2	Subgroup IB1	Subgroup IB2
1. Glycine 1 tablet (0.1 g) 3 times a day for 30 days* 2. Nervoheel 1 tablet 3 times a day for 30 days	1. Glycine 1 tablet (0.1 g) 3 times a day for 30 days* 2. Nervoheel 1 tablet 3 times a day for 30 days 3. Prifinium bromide 1 table (0.3 g) 3 times a day for 10 days	1. Mebicar 1 tablet (0.3 g) 3 times a day for 30 days* 2. Nervoheel 1 tablet 3 times a day for 30 days	1. Mebicar 1 tablet (0.3 g) 3 times a day for 30 days* 2. Nervoheel 1 tablet 3 times a day for 30 days 3. Domperidone 1 tablet (0.1 g) 3 times a day for 10 days

Note: * — according to the local clinical protocol for providing medical care to children with vegetative vascular dystonia under the inpatient conditions of the Kyiv City Children’s Clinical Hospital 2 dated July 19, 2020.

Table 4. *Evaluation of the effectiveness of treatment in children of the main group (n = 87) after 30 days by symptoms of digestive disorders*

Subgroups	Symptoms							
	Stomach pain		Nausea		Belching		Appetite disorders	
	n	%	n	%	n	%	n	%
Subgroup IA1 (n = 9)	5	55.5	4	44.4	3	33.3	2	22.2
Subgroup IA2 (n = 9)	2	22.2	1	11.1	1	11.1	1	11.1
Subgroup IB1 (n = 35)	22	62.8*	15	42.8*	12	34.2*	7	20.0
Subgroup IB2 (n = 34)	5	14.7*	3	8.8*	2	5.9*	3	8.8

Note (here and in Table 5): * — the difference of symptoms in children of subgroups IA1 and IA2, subgroups IB1 and IB2 is statistically significant, $p < 0.05$ according to Fisher’s exact test.

and 27.0 % of cases, respectively) than in subgroups IA2 and IB2 (10.0 and 12.0 %).

The recurrence of clinical manifestations of motility disorders of the UDT was more often identified in subgroups IA1 and IB1 (34.2 and 31.4 % of patients, respectively) than in subgroups IA2 and IB2 (11.1 and 14.3 %).

It was found that the comprehensive treatment allows to reduce ($p = 0.03$) the risk of recurrences; the overall effectiveness ratio was 0.39 (95% confidence interval 0.17–0.92) compared to basic therapy.

The analysis of the obtained results showed that the use of drugs affecting the motor function of the UDT in the comprehensive treatment of children with ANS dysfunction significantly ($p < 0.05$) increases its effectiveness during a 30-day course (89.0 versus 57.0 % in cases of slowed motor function of the UDT).

The ultrasound examination of the stomach with filling after the treatment course demonstrated that children of subgroups IA2 and IB2 who received correction for motility disorders of the UDT in addition to basic therapy for ANS dysfunction has a significant ($p < 0.05$) reduction in these disorders compared to patients from subgroups IA1 and IB1 who received only basic therapy for ANS dysfunction (Table 6).

During FEGDS conducted after a treatment course, duodenogastric reflux as a disorder of the motor function of the UDT was identified in 2.3 % of cases in the main group. Before treatment, 16.5 % of children in this group had it. These data indicate a significant improvement in the motor function of the UDT after the treatment course.

Upon examining the main group for *H.pylori* infection using the stool test after the treatment course, a positive *H.pylori* status was identified in 25.3 % of cases compared to 31.1 % before treatment ($p = 0.50$), indicating the therapy conducted had no effect on the rate of *H.pylori* infection in children with ANS dysfunction and motility disorders of the UDT.

After the treatment course, the levels of personal and situational anxiety were assessed in children of subgroup IB2 who received correction for motility disorders of the UDT in addition to basic therapy for ANS dysfunction, showing a decrease ($p < 0.05$) in the degree of personal anxiety compared to subgroup IB1 that received only basic therapy for ANS dysfunction.

The analysis of psychological disorders after the treatment course revealed that children of subgroup IB2 who received correction for motility disorders of the UDT in addition to basic therapy for ANS dysfunction experienced a significant ($p < 0.05$) improvement in psychological state compared to subgroup IB1, which received only basic therapy for ANS dysfunction.

All patients underwent a study of autonomic regulation of heart rhythm using cardiointervalography with the Cardiospectr device after the treatment course.

The results of the children examination were as follows: in subgroup IA1, 7 (77.8 %) patients had parasympathetic dominance, 1 (11.1 %) had sympathetic dominance, and 1 (11.1 %) child had normotonic indicators of the cardiogram; in subgroup IA2, 2 (22.2 %) patients had parasympathetic dominance, 1 (11.1 %) had sympathetic dominance, and 6 (66.7 %) children had normotonic indicators of the cardiogram. In subgroup IB1, 15 (42.9 %) patients showed sympathetic dominance, 3 (8.6 %) had parasympathetic dominance, and 17 (48.5 %) children had normotonic indicators of the cardiogram; in subgroup IB2, 1 (2.9 %) child had parasympathetic dominance, 9 (26.5 %) had sympathetic dominance, and 24 (70.6 %) children had normotonic indicators of the cardiogram (Table 7).

The obtained results showed that in patients of subgroup IA2, thanks to the course of basic therapy for ANS dysfunction and correction of accelerated motor function of the UDT, there is a higher level of normotonia and a decrease

Table 5. Evaluation of the effectiveness of treatment in children of the main group ($n = 87$) after 30 days by symptoms of autonomic dysfunction

Subgroups	Symptoms							
	Headache		Increased fatigue		Heart pain		Emotional lability	
	n	%	n	%	n	%	n	%
Subgroup IA1 ($n = 9$)	5	55.5	4	44.4	–	–	3	33.3
Subgroup IA2 ($n = 9$)	2	22.2	2	22.2	–	–	1	11.1
Subgroup IB1 ($n = 35$)	12	34.2*	11	31.4*	1	2.8	10	28.5
Subgroup IB2 ($n = 34$)	2	5.8*	3	8.8*	–	–	4	11.7

Table 6. Motility disorders of the UDT in children of the main group ($n = 87$) after a course of treatment

Subgroup IA ($n = 18$)				Subgroup IB ($n = 69$)			
Subgroup IA1		Subgroup IA2		Subgroup IB1		Subgroup IB2	
n	%	n	%	n	%	n	%
8	88.9	2	22.2*	33	94.3	5	14.7*

Note: * – the difference between the indicators in subgroups IA2 and IB2 and in subgroups IA1 and IB1 is statistically significant ($p < 0.05$).

Table 7. Autonomic regulation of heart rhythm in children of the main group (n = 87) after a course of treatment

Autonomic regulation of heart rhythm	Subgroup IA (n = 18)				Subgroup IB (n = 69)			
	Subgroup IA1		Subgroup IA2		Subgroup IB1		Subgroup IB2	
	n	%	n	%	n	%	n	%
Parasympathicotonia	7	77.8	2	22.2	3	8.6	1	2.9
Sympathicotonia	1	11.1	1	11.1	15	42.9	9	26.5
Normotonia	1	11.1	6	66.7*	17	48.5	24	70.6

Note: * — the difference in the distribution of indicators in subgroups IA2 and IB2 and in subgroups IA1 and IB1 is statistically significant ($p < 0.05$ according to the I-square test).

in parasympathetic dominance indicators compared to subgroup IA1, which received only treatment for ANS dysfunction (the difference from group IA1 is statistically significant, $p < 0.05$). In children of subgroup IB2, after basic therapy for ANS dysfunction and correction of slowed motor function of the UDT, there is a slightly higher level of normotonia and a reduction in sympathetic dominance indicators compared to subgroup IB1, which received treatment for ANS dysfunction only (however, no statistically significant difference between the groups was found, $p > 0.05$).

Therefore, it can be concluded that the comprehensive treatment for ANS dysfunction and motility disorders of the UDT positively affects not only the disorders of the digestive tract motility but also normalizes the autonomic regulation of heart rhythm. The latter has a positive prognosis for the further course of ANS dysfunction in patients.

Discussion

It can be concluded that motility disorders of the UDT are observed in 80.0 % of children with ANS dysfunction. In 63.3 % of cases, a slowing of motor function is detected, and in 16.5 %, its acceleration. The predominance of slowed motor function in children with motility disorders of the upper digestive tract coincides with the data of other researchers [9, 11]. This indicates certain characteristics of the motility disorders of the gastrointestinal tract in children with autonomic dysfunction.

Most often, according to our data, such changes are observed equally in boys and girls aged 6–16 years against a background of complicated perinatal history and a family history of digestive disorders. The family rate of gastrointestinal diseases in parents of children in the main group was significantly higher than in the comparison one. Other researchers also note the influence of heredity on the occurrence of digestive pathology, namely the development of motility disorders of the digestive tract [10].

The clinical symptoms of motility disorders of the UDT in children with ANS dysfunction is characterized by the presence of an abdominal pain syndrome in 93.5 % and nausea in 81.6 % of cases. The predominance of abdominal pain among clinical manifestations of motility disorders of the upper digestive tract coincides with the data of other authors [5, 6].

Using the stool test, a positive *H.pylori* status was found in 31.0 % of children with motility disorders of the upper digestive tract and autonomic dysfunction syndrome, in-

dicating that it does not influence the occurrence of this pediatric pathology, which coincides with the data of other researchers [4, 7].

Conclusions

1. In the syndrome of autonomic dysfunction, disorders of the motor function of the upper digestive tract are observed in 79.8 % of children (51.3 % of girls and 48.6 % of boys) and are most often accompanied by complaints of abdominal pain (93.5 %) and nausea (81.6 %).

2. The most significant risk factors for the occurrence of motility disorders of the upper digestive tract in children with the syndrome of autonomic dysfunction are a complicated perinatal history and the presence of organic gastrointestinal pathology in the parents of the examined children.

3. *H.pylori* infection was identified in 31.0 % of children with motility disorders of the upper digestive tract and the syndrome of autonomic dysfunction and in 13.6 % of children with the syndrome of autonomic dysfunction without motility disorders, indicating no correlation between *H.pylori* infection and the occurrence of these disorders ($p = 0.12$).

4. The use of drugs affecting the motor function of the upper digestive tract in the comprehensive treatment of children with the syndrome of autonomic dysfunction increases ($p < 0.05$) its effectiveness during a 30-day course (89.0 versus 57.0 % in cases of slowed motor function).

5. Medication correction for motility disorders of the upper digestive tract improves the long-term treatment outcomes in the syndrome of autonomic dysfunction. The recurrence of clinical manifestations of the syndrome of autonomic dysfunction was lower in subgroups with the comprehensive treatment (11.1 and 14.3 %) than in subgroups without the comprehensive treatment (33.3 and 35.0 %); the overall effectiveness ratio was 0.39 (95% confidence interval 0.17–0.92) compared to basic therapy ($p = 0.03$).

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Information about authors

Y.V. Karulina, PhD, Associate Professor at the Department of Pediatrics 2, Bogomolets National Medical University, Kyiv, Ukraine; e-mail: karulina@ukr.net; <https://orcid.org/0000-0001-5044-2999>
 T.I. Shevtsova, PhD, Associate Professor at the Department of Pediatrics 2, Bogomolets National Medical University, Kyiv, Ukraine; e-mail: t_shevtsova@ukr.net; <https://orcid.org/0000-0003-1884-5987>

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Каруліна Ю.В., Шевцова Т.І.

Національний медичний університет імені О.О. Богомольця, м. Київ, Україна

Лікування порушень моторної функції верхніх відділів травного тракту в дітей із вегетативною дисфункцією

Резюме. **Актуальність.** Останнім часом відмічається зростання поширеності вегетативної дисфункції (ВД) та на її фоні — порушень моторної функції верхнього відділу травного каналу (ВВТК), що є основою для формування хронічної патології органів травлення в дітей. **Мета:** удосконалити лікування дітей із ВД шляхом вивчення виду порушень моторної функції ВВТК та призначення схем терапії залежно від типу розладів моторики. **Матеріали та методи.** У статті наведено результати клініко-анамнестичного, лабораторного, інструментального та психологічного дослідження 109 дітей віком 6–16 років з вегетативною дисфункцією. **Результати.** Усі обстежені були поділені на дві репрезентативні групи: основну (група І, n = 87) — діти із синдромом ВД і порушеннями моторної функції ВВТК, які за типом останньої були розділені на дві підгрупи: ІА — з прискоренням цієї функції (n = 18) та ІВ — з її уповільненням (n = 69); групу порівняння (група ІІ, n = 22) — діти із синдромом ВД без розладів моторної функції ВВТК. З метою проведення лікування підгрупи ІА, у свою чергу, було поділено на дві терапевтичні підгрупи: ІА1 — тільки базисна терапія синдрому ВД та ІА2 — крім

базисної терапії синдрому ВД, проводили корекцію порушень моторної функції ВВТК. Пацієнти підгрупи ІВ також були поділені на дві підгрупи: ІВ1 — тільки базисна терапія синдрому ВД та ІВ2 — крім базисної терапії синдрому ВД, виконували корекцію порушень моторики ВВТК. Доведено ефективність лікування синдрому вегетативної дисфункції з урахуванням типу моторних розладів ВВТК. Були запропоновані різні схеми лікування дітей із ВД без порушень функції ВВТК та з наявністю розладів моторики. Застосування в комплексній терапії дітей із синдромом вегетативної дисфункції препаратів, що впливають на моторну функцію верхнього відділу травного каналу, вірогідно підвищує її ефективність при лікуванні протягом 30 днів (89,0 проти 57,0 % при уповільненні моторної функції). **Висновки.** Доведено ефективність комплексного лікування вегетативної дисфункції з урахуванням типу моторних розладів ВВТК, що вірогідно знижує ризик виникнення рецидивів патології органів травлення в дітей.

Ключові слова: вегетативна дисфункція; рухова функція; діти