

## Effect of physical therapy, Thai acupressure technique, and Nordic walking on the autonomic dysfunction syndrome

OLEKSANDR NIKOLENKO<sup>1</sup>, NATALIJA NESTERCHUK<sup>2</sup>, LILIYA TRYFONYUK<sup>3</sup>,  
MAREK NAPIERAŁA<sup>4</sup>, KRYSZTYAN KAŁUŻNY<sup>5</sup>, RADOSŁAW MUSZKIETA<sup>6</sup>

<sup>1,2</sup>Department of Physical Therapy and Occupational Therapy, National University of Water and Environmental Engineering, UKRAINE

<sup>3</sup>Institute of Health, National University of Water and Environmental Engineering, Rivne, UKRAINE

<sup>4</sup>University of Economy, Bydgoszcz, POLAND

<sup>5</sup>Faculty of Health Sciences, Ludwik Rydygier Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University, Torun, POLAND

<sup>6</sup>Nicolaus Copernicus University, Torun, POLAND

Published online: October 30, 2021

(Accepted for publication October 15, 2021)

DOI:10.7752/jpes.2021.s5387

### Abstract

Recent studies have shown an increase in various disorders in the health of young people. Analysis of the structure of morbidities shows that the diseases of the cardiovascular system are placed on the top, among which the syndrome of autonomic dysfunction in students is most common. Currently, autonomic disorders are one of the most pressing problems in the health of young people due to the significant spread of this pathology, which is 20 to 60% of the total incidence of people of all ages, according to various authors. The most common disorders of the autonomic nervous system occur among adolescents and students, due to hormonal changes in the body during puberty, stress on the functioning of various organs and systems, and significant mental and physical overload. Despite the fact that the syndrome of autonomic dysfunction is considered as a prognostically favourable functional disease at this age, many scientists talk about a fairly high risk of its transition to cardiovascular disease, in particular, hypertension. Among the most important etiological factors of the syndrome of autonomic dysfunction are hereditary predisposition, which causes this pathology of a constitutional nature, i.e. hereditary or congenital syndrome. The study found that the use of basic means of physical therapy along with the technique of Thai acupressure and Nordic walking improved students' well-being and basic vital signs. The use of this technique along with Thai acupressure and Nordic walking allowed us to accurately assess its effectiveness and analyse the dynamics of the selected indicators. Study participants: 48 students of the main group with autonomic dysfunction syndrome were involved. The article reflects a positive change in the functional status of the body and the improvement of general blood circulation and the overall beneficial effect on the nervous and cardiovascular systems. Conclusions: the chosen programme of physical therapy along with Thai acupressure and Nordic walking helps overcome the syndrome of autonomic dysfunction and improves the recovery processes and overall health.

**Key words:** autonomic dysfunction syndrome, physical therapy, Thai acupressure, Nordic walking

### Introduction

Autonomic dysfunction syndrome is a polyetiological syndrome characterized by the dysfunction of the autonomic nervous system and functional (i.e. inorganic) disorders of almost all body systems. It covers a whole set of symptoms. It is most often diagnosed when a patient feels anxiety and restlessness, has sleep disorder, shortness of breath (dyspnea), a "lump in the throat", and trembling hands, complains of rapid heartbeat, pressure fluctuations, pain in the heart, and, at the same time, has a normal electrocardiogram (ECG); has abdominal discomfort, constipation, diarrhea, flatulence or heartburn; has dizziness, fever; and examinations show that there are no inflammatory processes in the body (Mishchenko et al., 2012).

These symptoms can occur in different combinations and not necessarily all at once. In fact, they can reveal several different diseases that need to be identified after a series of thorough examinations.

Autonomic dysfunction syndrome is one of the most common pathological conditions among all somatic pathologies of adolescence and its prevalence is second only to viral infections.

Recently, there has been an increase in the prevalence of autonomic dysfunction among students, which can be attributed to the deteriorating environmental situation, increase in the workload at the university, reduction in the number of students joining different sports clubs, and other similar reasons. In addition, despite the treatment, 33,3% of students suffer from autonomic disorders for many years, and 17-20% of students may

experience their progress, which can cause the development of severe somatic diseases (Leshenko et. al., 2018; Bysmak et. al., 2012; Olkhovyk et. al., 2011).

At present, there is no doubt, that *autonomic dysfunction syndrome* is not a single disease with a clear pathogenesis and clinical picture, but is a group of pathological conditions, the main feature of which is increased or lowered blood pressure. The mechanisms of the syndrome of autonomic dysfunction and the role of different body systems in this pathological process are different.

Therefore, the development of a common approach to the treatment of this disease is irrelevant. There is no doubt that in the future the nosological units of autonomic dysfunction syndrome with clear etiology and pathogenesis will be identified. This will naturally lead to the creation of appropriate approaches, methods of treatment, and preventive measures. Literature data indicate insufficient effectiveness of existing physical therapy regiments for patients with autonomic dysfunction syndrome, which may be determined by the variety of etiopathogenetic mechanisms of this disease (Goren et. al., 2006; Olyshevskiy et. al., 2009). It is proved that stress, which is considered to be one of the etiological factors in the development of autonomic dysfunction syndrome, is only one of the reactions that constitute the general periodic system of nonspecific adaptive reactions of the body (Harkavi et. al., 2006).

Thus, the high prevalence of autonomic dysfunction syndrome, the possibility of its transformation into a variety of functional and organic pathology, insufficient effectiveness of existing methods of physical therapy of students with pathology, lack of physical therapy along with Nordic Walking and the techniques of Thai acupressure for these patients, the imperfection of the assessment of the effectiveness of the study of adaptive changes in the health of students determine the relevance of the topic and the purpose of the study.

The prevalence of autonomic disorders (Vshyvkyina et. al., 2002) accounts for 20% to 56% of all diseases of adolescence. Most often the symptoms of autonomic dysfunction are observed in students; their frequency in the male population ranges from 54.6% to 72.6%, and among female from 62.4% to 78.2%, due to pubertal hormonal changes in the body, stress on the functioning of various organs and systems, and significant mental and physical stress. In this paper, we would like to show how the use of basic physical therapy along with Thai acupressure and Nordic Walking can affect the cause of autonomic dysfunction in students and improve their health. At the present stage of development of medicine and non-traditional remedies, we have the opportunity to improve the treatment and prevention of autonomic dysfunction.

Autonomic dysfunction develops when the nerves of the autonomic nervous system are damaged. This condition is called autonomic neuropathy or dysautonomia. Autonomic dysfunction can range from mild to life-threatening. It can affect part of the autonomic nervous system or the entire autonomic nervous system. Sometimes the conditions that cause problems are temporary and reversible. Others are chronic, or long term, and may continue to worsen over time (Allcock et. al., 2005; Rove et. al., 1998; Timmers et. al., 2002; Flackenecker et. al., 2003).

**The purpose** of this study was to evaluate the outcome of our treatment. The main means of physical therapy and the feasibility of using Thai acupressure and Nordic Walking were analyzed (Krapivina et. al., 2006; Grygus et. al., 2019; Nesterchuk et. al., 2020).

### **Material and methods**

The study of autonomic homeostasis includes the assessment of the initial autonomic tone, autonomic reactivity and autonomic support of organs and systems, such as cardiovascular.

The programmes of physical therapy of patients with the syndrome of autonomic dysfunction obtained from foreign sources were analysed in order to determine the direction of the rehabilitation process and the impact of rehabilitation methods on the patient's health (Krapivina et. al., 2006).

In our study, pedagogical observation was conducted on the basis of the National University of Water and Environmental Engineering in the rehabilitation center of the Department of Physical Therapy, Occupational Therapy, Rivne. The observation made it possible to obtain primary data in the form of empirical statements. It included assessment of the physical condition of students in everyday life, determination of morpho-functional indicators, cooperation of students and teachers.

### *Participants*

Our research embraced the participation of 48 students of the main. A written consent to participate in the study was obtained from each participant to be subject to basic physical therapy, Thai acupressure and Nordic Walking. The researchers also informed the students about the benefits and risks that might arise from participating in the study.

The main advantages of Thai acupressure under the presence of autonomic dysfunction syndrome (fig. 1):

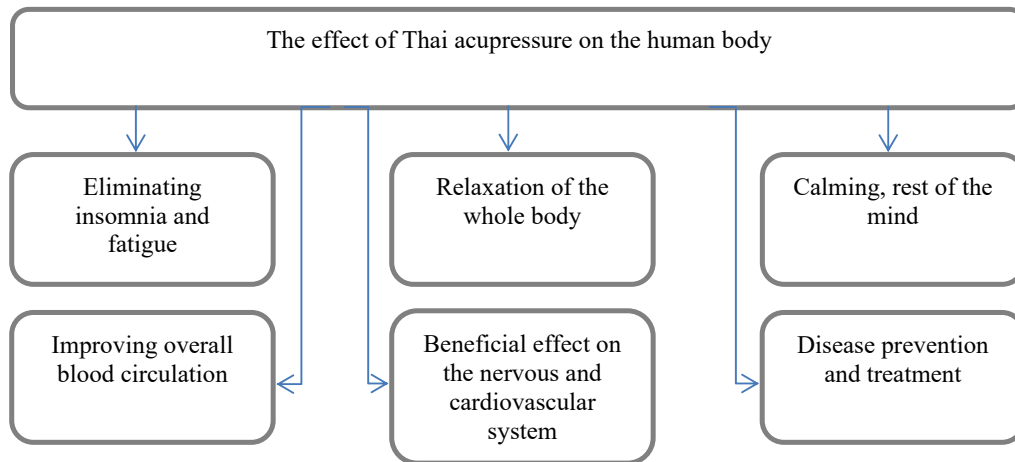


Fig. 1. The effect of Thai acupressure on the human body

The use of Nordic Walking is relevant because it is a very loyal sport to any conditions, age and well-being. Prolonged movement at a steady pace stimulates the heart. Oxygen uptake increases by several times during exercising, causing the heart to distil blood volumes by more than several times compared to rest time. Active blood circulation dilated blood vessels, thus toning not only the body but also the entire cardiovascular system. The heart pumps blood faster due to the hydrodynamic effect that occurs when a person hits the ground with a stick and heel at the same time; it causes the blood vessels to vibrate and helps the heart to pump blood faster, and increased blood circulation speeds up metabolism.

Determination of the vital capacity of the lungs (VCL) allowed us to assess the state of oxygen supply to the body, as well as to assess the heart function (PI) with the Ruffier functional test, i.e. the state of functioning of the cardiovascular system at rest and after dosed exercising respectively. The following formulas were used to determine these indices:

- $VCL = 40 \cdot X + 10 \cdot Y - 3800$

where X is height in cm., Y is weight in kg.

- $PI = \frac{4 \times (HR_1 + HR_2 + HR_3) - 200}{100}$ ;

According to the relevant recommendation, to obtain the value of PI, a special functional test was performed, which involved the use of the method of pulse oximetry. In particular, the heart rate (HR) of the student was determined for 15 seconds in the sitting position after five minutes of rest, as well as for 15 seconds of rest after 30 deep squats (arms forward) within 45 seconds and starting from 45 seconds of the first minute of rest after squats, i.e. HR<sub>1</sub>, HR<sub>2</sub>, HR<sub>3</sub>, respectively.

The results of the test with respiratory arrest were used to assess the body's oxygen supply. They also characterize the general level of human training. It is carried out in two versions: respiratory arrest on inhalation (Stange's test) and respiratory arrest on exhalation (Gench's test). It is assessed by the length of arrest time and by the response of heart rate. The latter is determined by the value of the ratio of heart rate after the test to the original pulse rate (Krapivina et. al., 2006). The diagnosis of the student's cardiovascular system was also performed by heart rate per minute. This simplified the action, increased efficiency and provided the possibility of constant and long-term monitoring of a relatively large group of parameters characterizing the state of cardiac activity. From a physiological point of view, heart rate is the average level of functioning of the cardiovascular system. Heart rate was defined as the value inverse to the mean duration of R-R intervals. After all, this indicator reflected the end result of numerous regulatory effects on sinus rhythm (Kapylevych et. al., 2008).

In addition, blood pressure, systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured using an electronic tonometer from Microlife. Based on heart rate and blood pressure, the following parameters were calculated:

- pulse pressure (PP) according to the formula:

$$PP = SBP - DBP;$$

- mean blood pressure according to Hickem's formula:

$$BP_{mean} = (PP / 3) + DBP.$$

The obtained empirical data were processed using a separate set of methods of mathematical statistics and the computer program "Statistica 13.0" and Microsoft Excel.

Experimental data were processed using conventional methods of mathematical statistics to determine the arithmetic mean ( $\bar{x}$ ), the standard error of the arithmetic mean (m).

## Findings

The use of physical therapy along with Thai acupressure and Nordic Walking in the main group improved the well-being of all study participants, which is confirmed by the indicators of functional tests performed before and after study.

*Table 1*

### **Positive tendency of change of functional indicators of students of the main study group**

Functional test	Findings before the start of the study (mean value of the main group of 48 participants)	Findings at the end of the study (mean value of the main group of 48 participants)
Blood pressure	106 by 66 mm Hg	112 by 68 mm Hg
Heart rate (per 1 min.)	82 beats per min.	73 beats per min
Stange's test	41 s	56 s
Gench's test	21 s	28 s
Ruffier's test	8	5
Vital capacity of the lungs	3640 ml	3790 ml

This change in functional status shows that by activating the circulation of all energy of a human and improving overall blood circulation and overall beneficial effects on the nervous and cardiovascular systems, the selected programme of physical therapy along with Thai acupressure and Nordic Walking helps overcome the autonomic dysfunction syndrome and improves the recovery processes and the overall health.

## Discussion

Literature analysis (Kozlova et. al., 2003) showed that comprehensive studies of clinical and laboratory, psychophysiological, neurophysiological, autonomic parameters in students with autonomic disorders, depending on the reactivity of the whole body to the disease, are insufficient. Under the presence of this disease, humoral changes increase the autonomic imbalance and provoke the development of biochemical and immunological changes in the body, with long-term preservation of which the student's body undergoes the development of psychosomatic disease (Bieliaieva et. al., 2003; Vein et. al., 2003; Ulashchuk et. al., 2015).

The obtained findings confirm that the developed programme of physical therapy along with Thai acupuncture and Nordic Walking has a positive effect on the functional state of the body and helps overcome the syndrome of autonomic dysfunction. For a long time, this disease is actively studied by a large number of scientists and physicians. Unfortunately, they have not come to a consensus on the pathogenesis of autonomic dysfunction syndrome, but identified a wide range of possible causes of the problem.

Modern scientific literature describes the use of means of physical therapy (medical physical training, physiotherapy, massage) for people suffering from autonomic dysfunction syndrome. After conducting a study using a comprehensive method of recovery for people with autonomic dysfunction syndrome, it can be claimed that the use of physical therapy has a positive effect on the recovery process. Scientific literature analysis confirmed the lack of research in the presence of autonomic dysfunction using physical therapy along with Nordic Walking and Thai acupressure, which suggests that the results presented in current studies are the first to evaluate the impact and effectiveness of our programme (Cariga et. al., 2002; Kihara et. al., 1998).

Interestingly, autonomic symptoms were not universal in those diagnosed with chronic fatigue syndrome, which may go some way towards explaining the conflicting literature in this area. Also, although broadly-based, the association did not cover the full range of autonomic symptoms. A particularly strong association was seen with symptoms of orthostatic intolerance, suggesting that abnormality of dynamic blood pressure regulation is particularly associated with fatigue severity in chronic fatigue syndrome (Leung et. al., 2003; Fukuda et. al., 1994).

## Conclusions

Literature analysis revealed a lack of information regarding the timely diagnosis of autonomic dysfunction syndrome and its final treatment programme. It is stated that the clinical cause of the disease is characterized by various and vague symptoms that can confuse even an experienced doctor, unstable low or high blood pressure, headache, dizziness, constant fatigue, numbness of various parts of the body, heart pain, chest tightness, frequent feeling of shortness of breath. It is determined that timely and successful formation of physical activity especially in the student life, is of paramount importance for full physical development, for students' interest in physical education. It is important that physical activity is presented in different forms (therapeutic gymnastics, dozed walking, fitness).

Our findings thus have implications for the broader context of autonomic dysfunction and disease. Further studies are needed to elucidate the multiple mechanisms responsible for the autonomic dysfunction in complex disease settings, but our findings support the hypothesis that autonomic dysfunction is a common pathway to the development of fatigue that can be triggered by a number of seemingly disparate disease processes. Further research is also needed to explore whether autonomic dysfunction arises as a primary defect,

or secondary from different abnormalities. Previous research approaches have tended to look at single diseases in isolation, which may have contributed to important ‘cross-cutting’ etiological mechanisms for development of autonomic dysfunction.

### Compliance with Ethical Standards

**Conflict of Interest.** The authors declare that there is no conflict of interest that could be perceived as interfering with publication of the article.

**Competing Interests.** The authors declare that they have no competing interests.

**Ethical Approval.** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent.** Informed consent was obtained from all individual participants included in the study. All subjects of the institutional survey gave consent for anonymized data to be used for publication purposes. Funding sources. This study has not received any financial support from any government, community or commercial organization.

### References

- Allcock L., Kenny R., Burn D. (2005). Clinical phenotype of subjects with Parkinsons disease and orthostatic hypotension: Autonomic symptom and demographic comparison, *Mov Disord*, 51-55.
- Anonymous Heart rate variability: standards of measurement, physiological interpretation and clinical use. (1996). Task force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, *Circulation*. 93. 43-65.
- Bynda, T., Maidannyk, V., Svalieva-Kulyk, N., Smiiian, O. (2014). Autonomic dysfunctions in children: a textbook. Sumy: Symy state university. 186. (in Ukrainian)
- Bysmak, E., Peshkova, O. (2012). Analysis of nosologies in students of a special medical group along with the use of modern means of therapeutic physical culture. Kharkov: KhDAVK: *Slobozhanskyi naukovy-sportyvnyi visnyk*, 148-153. (in Russian)
- Caetano, Joana, and José Delgado Alves. (2015). Heart rate and cardiovascular protection. *European journal of internal medicine*, 26.4: 217-222.
- Cariga P., Ahmed S., Mathias C., Gardner B. (2002). The prevalence and association of neck (coat-hanger) pain and orthostatic (postural) hypotension in human spinal cord injury, *Spinal cord*. 77-82.
- Diachenko-Bohun, M., Hrytsai, N., Grynova, M., Grygus, I., Muszkieta, R., Napierała, M., Zukow, W. (2019). Characteristics of Healthbreakers in the Conditions of Realization of Health-Safety Technologies in Education Structures. *International Journal of Applied Exercise Physiology*, 8(3.1), 1-8.
- Flackenecker P., Rufer A., Bihler I., Hippel C., Reiners K., Toyka K. (2003). Fatigue in MS is related to sympathetic vasomotor dysfunction, *Neurology*. 51-53.
- Fukuda K., Straus S., Hickie I., Sharpe M., Dobbins J., Komaroff A. (1994). International Chronic Fatigue Syndrome Study Group. The Chronic Fatigue Syndrome: A Comprehensive Approach to Its Definition and Study, *Ann Int Med*. 53-59.
- Kapilievych, L., Soltanova, V., Davletiarova, K. (2008). Organization of physical therapy classes with students exempted from physical education. *Theory and practice of physical education*. 174-176. (in Russian)
- Kihara M., Nakashima H., Takahashi M., Kawamura Y. (1998). A dysautonomia case of Guillain-Barré syndrome with recovery: Monitored by Composite Autonomic Scoring Scale, *J Auton Nerv Syst*. 186-189.
- Krapivina, K., Musienko, O., Savka, I., Khoma, S. (2006). Rehabilitation of patients with vegetative-vascular dystonia by means of respiratory gymnastics. Kyiv, 73-76. (in Ukrainian)
- Kuchanskaya, A. (1998). Vegetative-vascular dystonia. Moskva: Fizkultura i sport. 96. (in Russian)
- Lavrin G.Z., Sereda I.O., Kuczer T.V., Grygus I.M., Zukow W. (2019). The Results of Student’s Survey on Models of Physical Education in Universities and Motivations to Encourage for Active Participation in Physical Education. *International Journal of Applied Exercise Physiology*. 8 (2). 140-143.
- Lazarus, R. (1970). Stress theory and psycho-physiological research. Lvov: Meditsyna. Emotsyonalnyi stress, 178-209. (in Russian)
- Leung M., Poon D. (2003). The effects of electro-acupuncture and transcutaneous electrical nerve stimulation on patients with painful osteoarthritic knees: a randomized controlled trial with follow-up evaluation. *The Journal of Alternative and Complementary Medicine*. 3. 641-649.
- Libina, A., Libin, A. (1998). Stress response style: psychological defense or coincidence with difficult circumstances. Moskva: Smysl: Stil chelovieka: psikhologicheskii analiz, 134-137. (in Russian)
- Lil’in, E., Tseka, O. (2007). Comprehensive rehabilitation of children and adolescents with arterial hypertension and hypotension. Moskva: OAO “Izdatielstvo Meditsyna”. 144. (in Russian)

- Mishchenko, T., Kharina, K. (2012). Herbastress in the treatment of patients with vegetative-vascular dystonia. Kharkiv: Institut nerolohiyi, psykhiiatriyi ta narkolohiy Natsionalnoyi akademiyi medychnykh nauk Ukrainy: *Ukrayinskyi visnyk psykhonevrolohiyi*, 102-105. (in Ukrainian)
- Momot O., Diachenko-Bohun M., Hrytsai N., Grygus I., Stankiewicz B., Skaliy A., Hagner-Derengowska M., Napierala M., Muszkieta R., Ostrowska M., Zukow W. (2020). Creation of a Healthcare Environment at a Higher Educational Institution. *Journal of Physical Education and Sport*, 20 (Supplement issue 2), 975–981.
- Nesterchuk N., Grygus I., Ievtukh M., Kudriavtsev A., Sokolowski D. (2020). Impact of the wellness programme on the students' quality of life. *Journal of Physical Education and Sport*, 20 (Supplement issue 2), 929–938.
- Olkhovyyk, A. (2011). Physical rehabilitation of students of a special medical group with a disease of vegetative-vascular dystonia by mixed type. Kharkiv: KhOVNOKU-KhDADM: *Pedagogika, Psykhologiya ta medyko-biologichni problemy fizychnoho vykhovannia ta sportu*, 54-56. (in Ukrainian)
- Petrulina, S., Fadiyeva, L., Bokov, H. (2005). Physical culture as the basis for the formation of a healthy lifestyle with students. Penza: Penzenskii gosudarstviennyi piedagogicheskii institut imeni V. Belinskogo. 20. (in Russian)
- Rove P., Calkins H. (1998). Neurally mediated hypotension and chronic fatigue syndrome. *Am J Med*, 15-21.
- Shabatura, M., Matiash, N., Motuznyi, V. (1997). Human biology. Kyiv: Geneza, 430. (in Ukrainian)
- Srypchenko, O., Dolynska, L., Ohorodniychuk, Z. (2001). Age and pedagogical psychology. Kyiv: Psykholohiya rannioyi yunosti. 112. (in Ukrainian)
- Timmers H., Wieling W., Soetekouw P., Bleijenberg G., Van Der Meer J., Lenders J. (2002). Hemodynamic and neurohumoral responses to head-up tilt in patients with chronic fatigue syndrome, *Clin Auton Res*. 73-80.
- Ulashchik V. (2015). Osnovy obshchei fizyoterapyi. Mynsk; Vytebsk, 312.
- Vein, A., Kolosova, O. (1971). Vegetative-vascular paroxysms. Clinic, pathogenesis, treatment. Moskva: Meditsyna. 165. (in Russian)
- Vrzhesnievskiy, I., Korobeinikov, H., Turchyna, N., Cherniaiev, E. (2012). Features of the organization of physical education classes in a special department of the university. Kharkov: KhGADI: *Phizicheskoye vospitaniye studentov*, 35-39. (in Russian)