

# The influence of the Yumeiho therapy procedure on central hemodynamics and its assessment

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## Abstract

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The **purpose** of the study was to determine changes in central hemodynamics under the influence of the Yumeiho therapy procedure and to develop criteria for their evaluation

**Material & Methods:** 55 people who received Yumeiho therapy procedures at the "Yumeiho" center in Lviv were under supervision. Of them, 29 women aged 38.7 (32.0; 52.4) years and 26 men aged 35.8 (29.0; 46.6) years. The average age of the examinees was 37.5 (31.5; 47.2) years. All individuals had non-specific signs of manifestations of osteochondrosis of the spine. The methodology for the study of the indicators of the cardiovascular system involved the recording of blood pressure (BP) and heart rate (HR) in the supine position after 5 minutes of rest before the procedure, as well as after 5 minutes of rest in the supine position after the completion of the Yumeiho therapy

**Results:** stroke volume (SV, cm<sup>3</sup>), cardiac output (CO, dm<sup>3</sup>), general peripheral vascular resistance (GPVR, dyn/s/cm<sup>-5</sup>), cardiac index (CI, dm<sup>3</sup>/m<sup>2</sup>) and stroke index (SI, cm<sup>3</sup>/m<sup>2</sup>) were calculated according to known formulas. The analysis of changes in hemodynamic parameters during 1014 procedures was carried out. It is shown that in the Yumeiho-therapy procedure, there is a significant decrease in SV, CO, CI, SI and an increase in GPRV, both in men and in women. There is a decrease in the kinetics of blood circulation to the hypokinetic level.

**Conclusions:** the conducted study made it possible to establish that under the influence of Yumeiho therapy in patients there is a significant decrease in SV (cm<sup>3</sup>), CO (dm<sup>3</sup>), CI (dm<sup>3</sup>/m<sup>2</sup>), SI (cm<sup>3</sup>/m<sup>2</sup>), and a significant increase in GPRV (dyn/s/cm<sup>-5</sup>). According to the apriori data of the percentile analysis of changes in hemodynamic parameters, the limits of pronounced deviations, which may indicate an inadequate reaction of the body to the procedure, are established. That is, the obtained results can be useful during operational control of the effect of the Yumeiho therapy procedure on the patient's body. In the future, it is possible to consider the use of Yumeiho therapy in cardiac patients.

**Key words:** procedure, physical rehabilitation, stroke volume, cardiac output, general peripheral vascular resistance.

## Анотація

**Олександр Романчук, Василь Ганіткевич. Вплив про-**

**цедури Юмейхо-терапії на центральну гемодинаміку та її оцінка. Метою** дослідження було визначити зміни центральної гемодинаміки за впливу процедури Юмейхо-терапії та розробити критерії їх оцінки. **Матеріал і методи:** під наглядом знаходились 55 осіб, які отримували процедури Юмейхо-терапії у центрі «Юмейхо» м. Львів. З них 29 жінок віком 38,7 (32,0; 52,4) років та 26 чоловіків віком 35,8 (29,0; 46,6) років. Середній вік обстежених складав 37,5 (31,5; 47,2) років. Всі особи мали неспецифічні ознаки проявів остеохондрозу хребта. Методика дослідження показників серцево-судинної системи передбачала реєстрацію артеріального тиску (АТ) та частоти серцевих скорочень (ЧСС) у положенні лежачи після 5-хвилинного відпочинку перед проведенням процедури, а також після 5-ти хвилин відпочинку у положенні лежачи після завершення процедури Юмейхо-терапії. **Результати:** розрахунковим методом визначались ударний об'єм (УО, см<sup>3</sup>), серцевий викид (ХОК, дм<sup>3</sup>), загальний периферичний опір судин (ЗПОС, дін/с/см<sup>-5</sup>), серцевий індекс (СІ, дм<sup>3</sup>/м<sup>2</sup>) та ударний індекс (УІ, см<sup>3</sup>/м<sup>2</sup>). Проведений аналіз змін показників гемодинаміки під час 1014 процедур. Показано, що в процедурі Юмейхо-терапії відбувається значуще зниження УО, ХОК, СІ, УІ та збільшення ЗПОС, як у чоловіків, так і у жінок. Відбувається зниження кінетики кровообігу до гіпокінетичного рівня. **Висновки:** проведено дослідження дозволило встановити, що за впливу Юмейхо-терапії у пацієнтів відбувається значуще зниження УО (см<sup>3</sup>), ХОК (дм<sup>3</sup>), СІ (дм<sup>3</sup>/м<sup>2</sup>), УІ (см<sup>3</sup>/м<sup>2</sup>), та значуще збільшення ЗПОС (дін/с/см<sup>-5</sup>). За апіорними даними перцентильного аналізу змін показників гемодинаміки встановлені межі виражених відхилень, які можуть свідчити про неадекватну реакцію організму на процедуру. Тобто, отримані результати можуть бути корисними під час оперативного контролю впливу процедури Юмейхо-терапії на організм пацієнта. В перспективі можна розглянути застосування Юмейхо-терапії у кардіологічних хворих.

**Ключові слова:** процедура, фізична реабілітація, ударний об'єм, серцевий викид, загальний периферичний опір судин.

## Introduction

Yumeiho therapy is a method of holistic approach used for the treatment of many diseases, as well as for improving the mental and physical condition of a person (Saionji M., 1990). It is widely used for various diseases of the muscu-

loskeletal system. Studies conducted by various authors demonstrated a reduction in pain and restoration of initial muscle elasticity and joint mobility in scoliotic disease and postural disorders, and showed its advantages compared to physiotherapy and an individual program of kinesitherapy (Acasandrei, L. & Macovei, S., 2014; Rajabi, R. et al., 2011). Other scientists have shown its effectiveness in chronic pain in the back and lower back (Gladović, N. et al., 2020; Nikolovska, L. & Arsik, N., 2021), cervical spine. The studies that showed the effectiveness of the recovery of elite athletes also were quite significant (Bogdan, C. et al, 2021; Espí-López, G., 2018). A number of authors demonstrated the beneficial effect of Yumeiho therapy on the course of menopause (Mehraban, Z. & Alizadeh, L., 2012). In previous studies, a positive effect of the Yumeiho therapy course on the morpho-functional state of the body (Romanchuk, O. & Hanitkevych, V., 2022) and the function of the respiratory system (Romanchuk, O. & Hanitkevych, V., 2022) of adolescents with posture disorders was demonstrated. Put it was shown to improve the mobility of the chest, its volume, increase in the vital capacity of the lungs, peak exhalation speed, hypoxic resistance of the body, etc.

Apriori, the positive influence of the corrective and mobilizing effects of Yumeiho therapy and manual therapy on the function of internal organs due to the influence on autonomic innervation is clear, but not always proven (Amoroso Borges, B. et al, 2018; Araujo, F. et al, 2019; Minarini, G., 2018; Wirth, B. et al, 2019). On the other hand, it requires appropriate research that would allow proving a direct effect on the function of certain organs (Benjamin, J. et al, 2020; Hinkeldey, N. et al, 2020; Simonelli, C. et al, 2019). Taking into account the holistic approach in the Yumeiho therapy method, it is important, in our opinion, to determine the impact on the hemodynamic system, as a system that provides the main adaptive and restorative mechanisms in the body of a healthy and sick person (Alsayani, K. et al, 2021; Guzii, O. et al, 2017, 2021).

The purpose of the study was to determine changes in central hemodynamics under the influence of the Yumeiho therapy procedure and to develop criteria for their evaluation.

## Material and methods of research

### Participants

55 people who received Yumeiho therapy procedures at the "Yumeiho" center in Lviv were un-

der supervision. Of them, 29 women aged 38.7 (32.0; 52.4) years and 26 men aged 35.8 (29.0; 46.6) years. The average age of the examinees was 37.5 (31.5; 47.2) years. All individuals had non-specific signs of the spine osteochondrosis manifestations, which in most cases appeared during prolonged forced standing, sitting positions, or during physical work. The most frequent complaint of these persons was constant pain in certain areas of the back, which varied with a change in the body position.

*Procedure*

All the examined underwent a course of Yumeiho therapy, which consisted of 8-10 procedures on average. Our study examined the dynamics of changes in the parameters of the cardiovascular system in people who received from 4 to 42 Yumeiho therapy procedures during 2020-2022. The Yumeiho therapy procedure involved the use of (Saionji M., 1990):

- 1) point massage,
- 2) bone and joint manipulation and mobilization techniques,
- 3) special physical exercises.

The average duration of the Yumeiho therapy procedure was 60 minutes.

Before the start of each procedure, people visiting the "Yumeiho" center had their body length

(BL) and weight (BW) measured in light clothes adapted for the procedure. The methodology of the study of the cardiovascular system indicators involved the recording of blood pressure (BP) and heart rate (HR) using an automatic tonometer Omron M3 Comfort (made in Japan). Cardiovascular system parameters were recorded in the supine position after 5 minutes of rest before the procedure, as well as after 5 minutes of rest in the supine position after the completion of the Yumeiho therapy procedure.

The research was conducted in accordance with the rules of the Declaration of Helsinki, 1975. All individuals signed appropriate forms of informed consent for conducting the study.

During the examination, systolic blood pressure (SBP, mm Hg), diastolic blood pressure (DBP, mm Hg), and heart rate (HR, min<sup>-1</sup>) were determined. Body mass index (BMI, kg/m<sup>2</sup>), body area (m<sup>2</sup>), pulse blood pressure (PBP, mm Hg), average blood pressure (ABP, mm Hg); stroke volume (SV, cm<sup>3</sup>), cardiac output (CO, dm<sup>3</sup>), general peripheral vascular resistance (GPVR, dyn/s/cm<sup>-5</sup>), cardiac index (SI, dm<sup>3</sup>/m<sup>2</sup>) and stroke index (CI, cm<sup>3</sup>/m<sup>2</sup>) were calculated according to known formulas (Romanchuk, O., 2010).

*Statistical analysis*

Non-parametric methods of statistical analysis

**Table 1.** Morphometric characteristics of the studied contingent, Me (Q<sub>1</sub>; Q<sub>3</sub>)

Parameters	All group	Men	Women
BL, cm	169,0 (165,0; 178,0)	183,0 (173,0; 187,0)	165,0 (163,0; 169,0)
BW, kg	67,6 (59,1; 83,4)	79,4 (66,9; 101,2)	62,9 (54,7; 74,7)
BMI, kg/m <sup>2</sup>	22,8 (20,6; 28,5)	24,8 (22,3; 29,3)	21,1 (20,4; 27,4)
Body square, m <sup>2</sup>	1,80 (1,68; 2,00)	2,05 (1,80; 2,27)	1,73 (1,58; 1,83)

**Table 2.** Changes in the routine parameters of the cardiovascular system in the Yumeiho-therapy procedure, Me (Q<sub>1</sub>; Q<sub>3</sub>)

Parameters		Whole group	Men	Women
		1014 procedures	427 procedures	587 procedures
SBP, mmHg	Before	120,0 (108,0; 131,0)	127,0 (118,0; 134,0)	113,0 (105,0; 128,0)
	After	120,0 (107,0; 132,0)	125,0 (118,0; 133,0)	110,0 (104,0 ;131,0)
	p =	0.267535	0.085018	0.999563
DBP, mmHg	Before	76,0 (71,0; 81,0)	77,0 (72,0; 83,0)	75,0 (70,0; 80,0)
	After	78,0 (73,0; 84,0)	80,0 (75,0; 86,0)	77,0 (72,0; 82,0)
	p =	0.000000	0.000000	0.000000
PBP, mmHg	Before	44,0 (36,0; 52,0)	48,0 (42,0; 53,0)	40,0 (33,0; 49,0)
	After	41,0 (33,0; 49,0)	44,0 (40,0; 49,0)	36,0 (30,0; 48,0)
	p =	0.000000	0.000000	0.000000
HR, min <sup>-1</sup>	Before	70,0 (63,0; 78,0)	69,0 (62,0; 78,0)	71,0 (64,0; 78,0)
	After	62,0 (58,0; 67,0)	63,0 (58,0; 69,0)	61,0 (57,0; 66,0)
	p =	0.000000	0.000000	0.000000
ABP, mmHg	Before	90,7 (83,7; 97,3)	93,3 (87,3; 99,7)	88,0 (81,7; 95,3)
	After	91,8 (85,3; 99,7)	95,0 (90,0; 101,0)	88,3 (83,0; 97,7)
	p =	0.000000	0.000000	0.000000

of the Statistica 10.0 program were used to analyze the research results. Research results are presented in the form of Me ( $Q_1$ ;  $Q_3$ ). The probability of differences between indicators was determined using the Wilcoxon test.

### Results of the study

In the table 1 presents the main morphometric indicators of the examined persons. Based on the BMI indicators, it can be stated that a certain number of subjects are overweight, both among men and among women.

In the table 2 presents the dynamics of changes in routine indicators of the cardiovascular system, which were determined at the beginning and at the end of the Yumeiho therapy procedure. In the Yumeiho therapy procedure, fairly characteristic changes in indicators of cardiovascular system activity occur, which are characterized by nonprobable changes in SBP (mmHg) in both men and women, which are accompanied by probable ( $p=0.000$ ) changes in HR ( $\text{min}^{-1}$ ), SBP (mmHg), DBP (mmHg), ABP (mmHg). Namely, there is a slight increase in DBP (mmHg) from 76.0 (71.0; 81.0) to 78.0 (73.0; 84.0) in the entire group, from 77.0 (72, 0; 83.0) to 80.0 (75.0; 86.0) among men and from 75.0 (70.0; 80.0) to 77.0 (72.0; 82.0) among women. With the same significance ( $p=0.000$ ) there is a decrease in HR ( $\text{min}^{-1}$ ) from 70.0 (63.0; 78.0) to 62.0 (58.0; 67.0) throughout the group, from 69 .0 (62.0; 78.0) to 63.0 (58.0; 69.0) among men and from 71.0 (64.0; 78.0) to 61.0 (57.0; 66.0) among women.

Such changes in the routine indicators of the cardiovascular system in patients in the Yumeiho

therapy procedure testify to a certain reorganization of central hemodynamics that occurs in the body. At the same time, it should be noted that the Yumeiho therapy procedure, although it involves performing most of the mobilization and manipulation techniques in the lying position of the patient, is still accompanied by a sufficient number of passive-active movements and techniques that are performed in the sitting position. That is, the probable effect of the influence of the horizontal position is definitely there, but there is also the effect of the use of mobilization and manipulation influences. First of all, this was shown in a previous study, when using the instrumental registration of indicators of the cardiorespiratory system, changes in many indicators of the activity of the cardiovascular and respiratory systems were determined under the direct influence of traction manipulations in the thoracic spine, which were performed in a sitting position (Romanchuk, O., 2022).

In the table 3 presents the calculated indicators of central hemodynamics, which testify to probable ( $p = 0.000$ ) changes in the indicators of SV ( $\text{cm}^3$ ), CO ( $\text{dm}^3$ ), CI ( $\text{dm}^3/\text{m}^2$ ), SI ( $\text{cm}^3/\text{m}^2$ ) and GPVR ( $\text{dyn/s/cm}^{-5}$ ). Namely, a significant decrease in SV ( $\text{cm}^3$ ) for the whole group from 51.4 (45.2; 58.2) to 48.8 (42.5; 55.4), for men – from 55.1 (45.8; 62 .8) to 50.6 (42.6; 59.3) and for women – from 50.3 (44.8; 55.0) to 48.2 (42.4; 53.7). A significant decrease in cardiac output (CO,  $\text{dm}^3$ ), which occurred both at the expense of HR ( $\text{min}^{-1}$ ) (Table 2) and at the expense of SV ( $\text{cm}^3$ ); for the whole group – from 3.7 (3.2; 4.2) to 3.1 (2.6; 3.5), for men – from 3.8 (3.3; 4.3) to 3, 3 (2.7; 3.7) and for women – from 3.6 (3.1; 4.1) to 2.9 (2.6; 3.4).

**Table 3.** Changes in central hemodynamic parameters in the Yumeiho therapy procedure, Me ( $Q_1;Q_3$ )

Parameters		Whole group	Men	Women
		1014 procedures	427 procedures	587 procedures
SV, $\text{cm}^3$	Before	51,4 (45,2; 58,2)	55,1 (45,8; 62,8)	50,3 (44,8; 55,0)
	After	48,8 (42,5; 55,4)	50,6 (42,6; 59,3)	48,2 (42,4; 53,7)
	$p =$	0,000000	0,000000	0,000000
CO, $\text{dm}^3$	Before	3,7 (3,2; 4,2)	3,8 (3,3; 4,3)	3,6 (3,1; 4,1)
	After	3,1 (2,6; 3,5)	3,3 (2,7; 3,7)	2,9 (2,6; 3,4)
	$p =$	0,000000	0,000000	0,000000
CI, $\text{dm}^3/\text{m}^2$	Before	1,99 (1,68; 2,36)	1,88 (1,60; 2,19)	2,11 (1,76; 2,45)
	After	1,67 (1,41; 1,96)	1,62 (1,35; 1,84)	1,69 (1,45; 2,02)
	$p =$	0,000000	0,000000	0,000000
SI, $\text{cm}^3/\text{m}^2$	Before	28,4 (24,4; 33,6)	27,6 (22,6; 32,7)	28,8 (25,3; 34,1)
	After	27,4 (22,8; 31,7)	25,9 (20,7; 30,9)	28,2 (23,9; 32,3)
	$p =$	0,000000	0,000000	0,000000
GPVR, $\text{dyn/s/cm}^{-5}$	Before	1938 (1674; 2342)	1968 (1709; 2307)	1923 (1651; 2359)
	After	2398 (2009; 2912)	2343 (2020; 2874)	2432 (1984; 2962)
	$p =$	0,000000	0,000000	0,000000

**Table 4.** Criteria for evaluating changes in central hemodynamic indicators in the Yumeiho therapy procedure

Parameters	Sex	<5%	5-25%	25-75%	75-95%	>95%
SV, cm <sup>3</sup>	M	<-12.5	-12.5 – -7.4	-7.3 – 0.5	0.6 – 5.5	>5.5
	F	<-10.8	-10.8 – -5.8	-5.7 – 0.9	1.0 – 5.7	>5.7
CO, dm <sup>3</sup>	M	<-1.445	-1.445 – -0.895	-0.894 – -0.224	-0.223 – 0.243	>0.243
	F	<-1.618	-1.618 – -0.947	-0.946 – -0.312	-0.311 – 0.062	>0.062
CI, dm <sup>3</sup> /m <sup>2</sup>	M	<-0.76	-0.75 – -0.44	-0.43 – -0.10	-0.11 – 0.12	>0.12
	F	<-0.92	-0.92 – -0.55	-0.54 – -0.17	-0.16 – 0.04	>0.04
SI, cm <sup>3</sup> /m <sup>2</sup>	M	<-6.53	-6.53 – -3.62	-3.61 – 0.28	0.29 – 2.97	>2.97
	F	<-6.66	-6.66 – -3.40	-3.39 – 0.50	0.51 – 3.35	>3.35
GPVR, dyn/s/cm <sup>-5</sup>	M	<-159	-159 – 158	158 – 657	658 – 1110	>1110
	F	<-68	-68 – 219	220 – 710	711 – 1286	>1286

Changes in CI (dm<sup>3</sup>/m<sup>2</sup>) and SI (cm<sup>3</sup>/m<sup>2</sup>) among all studied groups were similar in terms of dynamics. Their changes can be characterized as indicating a decrease in blood circulation kinetics to a hypokinetic level.

Also, the changes that occurred in the parameters of the total peripheral resistance of the vessels (GPVR, dyn/s/cm<sup>-5</sup>) turned out to be unidirectional in the direction of increase. For the whole group – from 1938 (1674; 2342) to 2398 (2009; 2912), for men – from 1968 (1709; 2307) to 2343 (2020; 2874) and for women – from 1923 (1651; 2359) to 2432 (1984; 2962). Such dynamics characterizes an increase in the vascular tone of peripheral vessels. The probability of such a reaction may be related to the tonic effects that are exerted during the Yumeiho therapy procedure on individual muscle groups with the use of point massage. However, in earlier studies, such an effect was noted separately after performing traction manipulations on the chest (Romanchuk, O., 2022).

That is, in the Yumeiho therapy procedure, changes in central hemodynamics occur, which, on the one hand, are characterized by the economy of the cardiovascular system activity, first of all, due to the reduction of the indicators of HR, SV, CO, CI, SI, and on the other hand, they contribute to the increase of indicators of DBP, ABP, GPVR, which in turn can be considered as a negative factor. However, changes in DBP and ABP occur within the normative values and do not reach pre- and hypertensive values. The most likely is their reaction to tonic passive effects on peripheral muscles.

In view of the obtained data, one of our tasks was to develop criteria for evaluating changes in central hemodynamic parameters under the influence of the Yumeiho therapy procedure. For this purpose, we used the well-known method of percentile analysis, which involves evaluation taking into account falling within certain limits

of the percentile distribution (Romanchuk, A. & Pizaruk, V., 2013). Most often, in practice, they use the distribution that takes into account entering the corridors in less than 5% of cases, from 5% to 25% of cases, from 25% to 75% of cases, from 75% to 95% of cases and more than 95% of cases (Panenko, A. et al, 2006; Guzii, O. et al, 2019). Each of these corridors from the point of view of statistical analysis can be characterized as a pronounced decrease, a moderate decrease, the norm, a moderate increase, and a pronounced increase, respectively (Panenko, A. et al, 2004). We analyzed individual changes in central hemodynamic indicators during the Yumeiho therapy procedure. The percentile limits of the ranges of changes that can be used as criteria for evaluating changes are presented in the table. 4.

The most optimal are changes that are within 25-75% occurrence. As an example, the optimal changes in the SV (cm<sup>3</sup>) in the Yumeiho therapy procedure are from a decrease of 7.3 cm<sup>3</sup> to an increase of 0.5 cm<sup>3</sup> in men and from a decrease of 5.7 cm<sup>3</sup> to an increase of 0.9 cm<sup>3</sup> in women. Changes in other parameters of central hemodynamics can be evaluated in a similar way.

However, it is more informative to determine the limits of deviations of central hemodynamic indicators, which are in the extreme ranges of the distribution – less than 5% and more than 95%. That is, which are quite rare and may indicate the development of negative reactions in patients.

As an example, consider changes in the cardiac output (CO, dm<sup>3</sup>). According to the data of the preliminary analysis, it was established that CO (dm<sup>3</sup>), both in men and in women, probably decreases under the influence of Yumeiho therapy (Table 3). From these positions, the optimal decrease in men is 224-894 cm<sup>3</sup>, in women – 312-946 cm<sup>3</sup>. That is, the normal response of CO (dm<sup>3</sup>) in men and women is proportional in the

reduction. A significant decrease in CO (dm<sup>3</sup>) can be associated with two main factors – a pronounced decrease in HR (min<sup>-1</sup>) or a pronounced decrease in SV (cm<sup>3</sup>). The first may indicate a weakness of the sinus node, a violation of intracardiac or atrioventricular conduction, and the second – a significant deterioration of the contractile function of the heart. What is the first, what is the second can have quite negative consequences for the patient's condition. In view of the results obtained by us, for men this is a reduction of CO by 1445 cm<sup>3</sup>, for women – 1618 cm<sup>3</sup>. No less threatening to the patient's condition is the increase in CO under the influence of the Yumeiho therapy procedure. The inadequacy of this reaction may be associated with excessive release of intercellular fluid into the bloodstream, or excessive activation of the sympathetic nervous system, which is possible when using some methods of Yumeiho therapy. In any case, an increase in CO is not characteristic of the reaction of the hemodynamic system to Yumeiho therapy. However, the greatest caution is required for CO values that exceed 243 cm<sup>3</sup> in men and 62 cm<sup>3</sup> in women. Such reactions may indicate the development of hypertensive conditions.

### **Discussion**

Operational monitoring of the condition of patients within physical rehabilitation procedures is an urgent task during the development of various rehabilitation programs. In any pathological conditions, the cardiorespiratory system, one of the links of which is the system of ensuring central hemodynamics, is the most reactive in terms of influence on physical means of rehabilitation (Alsayani, K. et al, 2021; Guzii, O. et al, 2017; Hinkeldey, N. et al, 2020). Its role is related to the proper provision of blood flow in various parts of the human body and depends on several components – the contractile function of the heart, the volume of circulating blood and the resistance of resistive vessels. All these components are exposed to one or another influence when using physical means of rehabilitation. From these positions, it is important to establish the most expected options for responding to physical influences, as well as options that are within the limits of rarely encountered, which require appropriate analysis to prevent adverse reactions of the body to the use of rehabilitation measures. The majority of studies aimed at determining the effects of certain means of physical rehabilitation are, as a rule, limited to the study of changes in the systems on which they are aimed. Of course, more often we are talking about the musculoskeletal system, the nervous system, and the metabolic

system (Hinkeldey, N. et al, 2020; Rajabi, R. et al, 2011). Certain studies are dedicated to the search for long-term effects of the use of physical rehabilitation aimed at the cardiorespiratory system, the main parameter of which is the oxygenation of the body according to the data of cardiopulmonary testing on a bicycle ergometer. At the same time, there are not many studies that analyze direct effects (Minarini, G. et al, 2018; Benjamin, J. et al, 2020; Alsayani, K. et al, 2021). This was due to many factors, first of all, the lack of an opportunity to conduct diagnostic studies directly at the place of application of the procedures. In recent years, with the spread of information technologies and the development of various sensors of physiological functions, such an opportunity has become available.

The purpose of the conducted research was to show the main hemodynamic effects of the Yumeiho therapy procedure, as well as to determine the optimal and extreme limits of their changes, which has a significant to help not only in the development of impact effectiveness criteria, but also in the further processing and feasibility of developing modern information technologies and sensors for possible use in rehabilitation practice.

In general, characterizing the obtained results, it should be noted that according to most indicators of central hemodynamics in the Yumeiho therapy procedure, clear unidirectional shifts are noted, which testify to the economization of the function of the cardiovascular system due to a decrease in the kinetics of blood circulation, and an increase in the kinetics should be considered as an inadequate reaction. However, these values also have a certain limit, the achievement of which should cause concern about the development of possible adverse reactions to the procedure.

The obtained effects are also important for patients with diseases of the cardiovascular system. Probably, among the next areas of research on the impact of Yumeiho therapy on the human body, it is advisable to conduct research in conjunction with cardiology specialists to establish the possibility of its use in the rehabilitation process of patients with cardiovascular system pathology.

### **Conclusion**

The conducted study made it possible to establish that under the influence of Yumeiho-therapy in patients there is a significant decrease in SV (cm<sup>3</sup>), CO (dm<sup>3</sup>), CI (dm<sup>3</sup>/m<sup>2</sup>), SI (cm<sup>3</sup>/

m<sup>2</sup>), and a significant increase in GPVR (dyn/s/cm<sup>-5</sup>). According to the a priori data of the percentile analysis of changes in hemodynamic parameters, the limits of pronounced deviations, which may indicate an inadequate reaction of the body to the procedure, are established.

#### **Conflicts of Interest**

The authors declare no conflict of interest.

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#### **References**

- Alsayani, K. Y. A., Aslan, U. B., Bükler, N., Şavkın, R., & Yağcı, A. B. (2021). The immediate effect of harmonic therapy on peripheral blood flow in young males: A cross-over pilot study. *International Journal of Osteopathic Medicine*, 42, 51–55. <https://doi.org/10.1016/j.ijosm.2021.11.001>.
- Amoroso Borges, B. L., Bortolazzo, G. L., & Neto, H. P. (2018). Effects of spinal manipulation and myofascial techniques on heart rate variability: A systematic review. *Journal of Bodywork and Movement Therapies*, 22(1), 203–208. <https://doi.org/10.1016/j.jbmt.2017.09.025>
- Araujo, F. X., Ferreira, G. E., Angellos, R. F., Stieven, F. F., Plentz, R. D. M., & Silva, M. F. (2019). Autonomic Effects of Spinal Manipulative Therapy: Systematic Review of Randomized Controlled Trials. *Journal of Manipulative and Physiological Therapeutics*, 42(8), 623–634. <https://doi.org/10.1016/j.jmpt.2018.12.005>
- Benjamin, J. G., Moran, R. W., Plews, D. J., Kilding, A. E., Barnett, L. E., Verhoeff, W. J., & Bacon, C. J. (2020). The effect of osteopathic manual therapy with breathing retraining on cardiac autonomic measures and breathing symptoms scores: A randomised wait-list controlled trial. *Journal of Bodywork and Movement Therapies*, 24(3), 282–292. <https://doi.org/10.1016/j.jbmt.2020.02.014>
- Bogdan, C. P., Liliana, M., & Carmen, B. (2021). Evaluation of lactic acid anaerobic effort capacity recovery through the association of Yumeiho therapy with other means of recovery. *Journal of Physical Education and Sport*, 21(1). doi: 10.7752/jpes.2021.01043
- Espí-López, G. V., López-Martínez, S., Inglés, M., Serra-Añó, P., & Aguilar-Rodríguez, M. (2018). Effect of manual therapy versus proprioceptive neuromuscular facilitation in dynamic balance, mobility and flexibility in field hockey players. A randomized controlled trial. *Physical Therapy in Sport*, 32, 173–179. <https://doi.org/10.1016/j.ptsp.2018.04.017>
- Gladović, N., Leško, L., & Fudurić, M. (2020). Effectiveness of manual yumeiho therapy and exercise on depression and neuropathic pain in patients suffering from chronic nonspecific low back pain. doi: 10.5817/cz.muni.p210-9631-2020-27
- Guzii, O., & Romanchuk, A. (2017). Differentiation of Hemodynamics of Top Athletes Depending on Heart Rate Variability after Training. *Journal of Advances in Medicine and Medical Research*, 22(3), 1–10. <https://doi.org/10.9734/JAMMR/2017/33619>.
- Guzii, O., Romanchuk, A., Mahlovanyi, A., & Trach, V. (2019). Polyfunctional express-evaluation criteria of the sportsman organism state. *Journal of Physical Education and Sport® (JPES)*, 19(4), 2352–2358. <https://doi.org/10.7752/jpes.2019.04356>
- Guzii, O., Romanchuk, A., Mahlovanyi, A., Trach, V. (2021). Post-loading dynamics of beat-to-beat blood pressure variability in highly trained athletes during sympathetic and parasympathetic overstrain formation. *Journal of Physical Education and Sport*, 21(5), 2622–2632. <https://doi.org/10.7752/jpes.2021.05350>.
- Hinkeldey, N., Okamoto, C., & Khan, J. (2020). Spinal Manipulation and Select Manual Therapies. *Physical Medicine and Rehabilitation Clinics of North America*, 31(4), 593–608. <https://doi.org/10.1016/j.pmr.2020.07.007>.
- Mehraban, Z., & Alizadeh, L. (2012). Yumeiho therapy and menopause. *Maturitas*, 71. doi: 10.1016/s0378-5122(12)70225-6
- Minarini, G., Ford, M., & Esteves, J. (2018). Immediate effect of T2, T5, T11 thoracic spine manipulation of asymptomatic patient on autonomic nervous system response: Single-blind, parallel-arm controlled-group experiment. *International Journal of Osteopathic Medicine*, 30, 12–17. <https://doi.org/10.1016/j.ijosm.2018.10.002>
- Nikolovska, L., & Arsik, N. (2021). Role of yumeiho therapy and acupressure in reducing back pain due to scoliosis and kyphosis of the spine. *Knowledge – International Journal*,

47(4):711-6.

- Panenko A., Noskin L., Romanchuk O. (2004). Indyvidual'ne sanotypuvannya yak osnova adresatnykh korektsiyno-reabilitatsiynykh zakhodiv. [Individual health typing as the basis of targeted corrective and rehabilitation measures]. *Odesa Medical Journal*, 1, 65–68. (in Ukrainian)
- Panenko A., Romanchuk O. (2006) Sanotypuvannya u vyznachenni morfofunktsional'nykh determinant vehetatyvnykh rozladiv [Sanotyping in the determination of morphofunctional determinants of vegetative disorders]. *Medical rehabilitation, balneology, physiotherapy*, 4, 30–34. (in Ukrainian)
- Rajabi, R., Farahani, A., & Zandi, S. (2011). A comparison of two methods of strengthening exercises with and without massage on alleviation of the chronic neck pain. *World Journal of Sport Sciences*, 5 (3): 158-62.
- Romanchuk, A., & Pizaruk, V. (2013). Change of central hemodynamics of qualified athletes for testing the use of controlled breathing and evaluation. *Pedagogics, Psychology, Medical-Biological Problems of Physical Training and Sports*, 11, 77–84. <https://doi.org/10.6084/m9.figshare.817930>
- Romanchuk, O. (2010). *Likars'ko-pedahohichnyy kontrol' v ozdorovchiy fizychniy kul'turi*. [Medical and pedagogical control in health-improving physical culture]. Odesa. 206. (in Ukrainian)
- Romanchuk, O. P. (2022). The Immediate Effects of the Manual Therapy Traction Manipulations on Parameters of Cardiorespiratory System Functioning. *International Journal of Human Movement and Sports Sciences*, 10(5), <https://doi.org/10.13189/saj.2022.100424>
- Romanchuk, O., & Hanitkevych, V. (2022). [Influence of Yumeiho therapy on morphometric parameters of adolescents with postural disorders]. *Physical Rehabilitation and Recreational Health Technologies*, 7(2), 43–47. doi: 10.15391/prht.2022-7.10 (in Ukrainian)
- Romanchuk, O. P., & Hanitkevych, V. I. (2022). [The influence of Yumeiho-therapy on the adolescent's respiratory system functional state with posture disorders]. *Rehabilitation and Recreation*, 11, 47–57. doi: 10.32782/2522-1795.2022.11.5 (in Ukrainian)
- Saionji M. (1990). *Hipbone yumeiho therapy*. Beijing: Xue Yuan (Academia).
- Simonelli, C., Vitacca, M., Vignoni, M., Ambrosino, N., & Paneroni, M. (2019). Effectiveness of manual therapy in COPD: A systematic review of randomised controlled trials. *Pulmonology*, 25(4), 236–247. <https://doi.org/10.1016/j.pulmoe.2018.12.008>.
- Wirth, B., Gassner, A., de Bruin, E. D., Axén, I., Swanenburg, J., Humphreys, B. K., & Schweinhardt, P. (2019). Neurophysiological Effects of High Velocity and Low Amplitude Spinal Manipulation in Symptomatic and Asymptomatic Humans: A Systematic Literature Review. *Spine*, 44(15), E914–E926. <https://doi.org/10.1097/BRS.0000000000003013>.