

## DYNAMICS OF KINESIOPHOBIA AND PHYSICAL FUNCTIONING PARAMETERS IN THE ELDERLY ADULTS WITH SARCOGENIC OBESITY UNDER THE INFLUENCE OF THE PHYSICAL THERAPY PROGRAM

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### Summary

**Aim:** to determine the effectiveness of a physical therapy program for the elderly with sarcopenic obesity in terms of the kinesiophobia and physical functioning parameters.

**Materials and methods:** We examined 106 elderly people, who were divided into 3 groups. The control group consisted of individuals with normal body weight and they had no sarcopenia. The main group 1 consisted of individuals with sarcopenic obesity and a weak therapeutic alliance; they were given general recommendations for modifying the diet and expanding physical activity. The main group 2 included patients with a strong therapeutic alliance. A one-year physical therapy program with the use of kinesitherapy, massage, dietary intervention, patient education, the elements of cognitive training and occupation therapy was developed for them. The dynamics were assessed by Tampa Kinesiophobia Scale, Fullerton Fitness Test, Edmonton Frail Scale.

**Results:** Elderly people with sarcopenic obesity have a high level of kinesiophobia (Tampa Kinesiophobia Scale), their physical status (coordination, balance, strength, flexibility, endurance, agility) significantly lags behind that of their peers (Fullerton Fitness Test), they suffer from the frailty (Edmonton Frail Scale). After applying the developed physical therapy program, it was possible to state that the individuals of the main group 2 showed a statistically significant ( $p < 0.05$ ) improvement in their physical functioning parameters relative to the indicators of their peers and initial parameters, a reduction in the frailty, decreasing in the level of kinesiophobia. The low level of the therapeutic alliance, despite the awareness of the negative consequences for the health, led to unsatisfactory implementation or non-implementation of the recommendations provided for the elderly with sarcopenic obesity and was associated with no improvement in the physical status, signs of frailty, kinesiophobia.

**Conclusions:** The developed physical therapy program for elderly patients with sarcopenic obesity against a background of a high level of the therapeutic alliance showed a statistically significant improvement in all studied indicators of kinesiophobia and physical functioning parameters compared to the initial level and the indicators of people with low levels of the therapeutic alliance.

**Key words:** physical therapy, frailty, old age, sarcopenic obesity, metabolic syndrome.

### INTRODUCTION

Frailty is one of the leading geriatric syndromes, which is characterised by a decrease in physiological reserve and functions of many body systems, which leads to increased vulnerability of the elderly to endogenous and exogenous factors, with a high risk of adverse health effects, loss of autonomy and death [1, 2]. Frailty is closely related to other geriatric syndromes, comorbidity and multimorbidity; it affects the tactics of treatment

and rehabilitation of the patient. Risk factors for frailty development also include low levels of physical activity, poor nutrition, depression, polypragmasy, and social factors [1, 3]. Basically, there are three interdependent age-related conditions causing the development of frailty: malnutrition, sarcopenia, a decrease in the metabolic rate and physical activity [4, 5]. Sarcopenia as the main part of frailty recognised as one of the five main risk factors for morbidity and mortality in people aged over 65, as the normal functioning of muscle tissue is the basis for keeping

one's balance, reducing the risk of falls, full self-care and normal activities of daily living [1, 5].

Obesity is an independent problem of modern civilized society, widespread among all age groups [7]. Elderly people are characterised by the development of sarcopenic obesity with a decrease in muscle mass against a background of increased fat mass, which causes more pronounced deterioration in the physical status than the presence of obesity or sarcopenia does [7, 8]. In turn, sarcopenia underlies the development of frailty [2, 4].

Accordingly, the highest frequency of metabolic syndrome, the main component of which is the abdominal type of obesity according to Body mass index in combination with high blood pressure and carbohydrate metabolism disorders [9], is observed in old age. The increase in the prevalence of diabetes mellitus in the elderly is associated with physiological changes in carbohydrate metabolism during aging [7]. Hyperglycemia, hypertension and lipid disorders adversely affect organs and systems, forming multiple organ failure and add complications to the cardiovascular system, kidneys, eyes, peripheral nervous system. Diabetes mellitus can accelerate the development of geriatric syndrome (sarcopenia), due to the fact that in diabetes a number of factors (hyperglycemia, complications of diabetes, obesity, insulin resistance, increased markers of chronic inflammation) accelerate muscle atrophy [10]. Regular exercise, as part of rehabilitation programs, is an important component of obesity correction [11].

The presence of comorbidity and multimorbidity, combined with polypragmasy in the elderly suffering from geriatric syndrome actualises the use of universal means of non-drug health improvement. This notion refers to physical activity in the form of kinesitherapy in physical therapy programs. In the elderly, physical activity that contributes to maintaining muscle mass and strength can simultaneously delay the onset of frailty and/or slow down its progression [3, 5].

Thus, the improvement to the physical and mental status of the elderly with comorbid pathological conditions in the context of being able to carry out household and, if necessary, professional activities, is of great socio-economic importance for society. This determines the relevance of the presented work, its theoretical and practical value.

**The aim:** to determine the effectiveness of the developed physical therapy program for the elderly with sarcopenic obesity using the dynamics of the kinesiophobia and physical functioning.

## MATERIALS AND METHODS

**Participants.** In the study, 106 elderly people were examined. Inclusion criteria: old age (60-75 years old

according to the classification of the World Health Organization (WHO)); the absence of aggravation of a chronic or acute pathological condition of internal organs at the time of the examination; for the participants of the main group – the presence of sarcopenic obesity as a combination of two conditions: 1. frailty (diagnosed by screening techniques [4]); 2. obesity as a component of metabolic syndrome (diagnosed as a combination of the abdominal obesity along with additional criteria – fasting hyperglycemia, hypertriglyceridemia, low levels of low-density lipoprotein [9]); the effectiveness of a proven rehabilitation intervention is presented in our previous article [12].

**Exclusion criteria:** the presence of an acute or chronic pathological condition of the nervous system and/or musculoskeletal system and/or consequences of them that could affect the studied indicators of the physical status; an acute or aggravated pathological condition of internal organs at the time of the examination; the presence of dementia of any origin.

**Procedure.** The control group (CG) consisted of 19 men, 15 women aged  $68.2 \pm 1.1$  without sarcopenic obesity (metabolic syndrome and frailty).

The main group (MG) consisted of 72 individuals with sarcopenic obesity. All of them had an explanatory educational discussion on the etiology, pathogenesis, clinical course, complications and comorbid conditions of frailty and metabolic syndrome; the substantiation of a positive influence of means of physical therapy, which will be used in the tested program, was provided. After that, according to the results of determining the desire for their own active participation in the process of improving their health under the supervision of a physical therapist (i.e. how strong the therapeutic alliance was), they were divided into 2 groups. The individuals from the main group 1 (MG1-16 men, 15 women aged  $67.2 \pm 0.9$ ) who did not wish to work with a physical therapist and/or actively improve their health (a low level of the therapeutic alliance) were provided with WHO. Healthy diet [13] on dietary modification and expanding household and physical activities, adapted to the needs of the elderly (according to the recommendations of American College of Sports Medicine's exercise testing and prescription) [14]. The main group 2 (MG2-18 men, 23 women aged  $66.9 \pm 1.2$ ) included patients who agreed to take active steps to improve their own health under the supervision of a physical therapist (a high level of the therapeutic alliance). A physical therapy program was developed for them, the effectiveness of which is presented in this study.

The developed program of physical therapy was being implemented for 1 year. The devised program included the following components:

- Kinesitherapy was employed to reduce the severity of frailty symptoms, maintain and restore patients' ability to take care of themselves, have functional activity

and independence from outside help in daily life. It could also improve their quality of life, minimize the risk of falls, and reduce the degree of sarcopenic obesity. Kinesitherapy was introduced in the form of classes with a physical therapist (functional and coordination-motor training on the platform «Prosedos»; resistance and load exercises with expanders «Thera-band», stretching; aerobic training); morning gymnastics; independent expansion of household and training physical activity. The physiological condition was controlled before classes, during classes, after classes (well-being, the level of shortness of breath, blood pressure, pulsometry, pulse oximetry);

- **Massage.** General, health-improving massage was used in order to accelerate recovery after training, improve blood supply and muscle tissue trophism;

- **Dietary intervention** had two directions – boosting weight loss (correction of daily caloric intake mainly by reducing the amount of carbohydrates) and compensating for sarcopenia by a diet (protein intake at a dose of at least 1 g per kg of body weight [1, 2, 6] and normalization of vitamin and micronutrient content of food). One feature of weight correction in the elderly with sarcopenic obesity was the achievement of the target body mass index of not less than 25-29.9 kg/m<sup>2</sup>, because in comparison to lower values, they are associated with a decrease rather than an increase in the risk of death [15];

- **Patient education** comprises informing the patients about the risks of frailty and metabolic syndrome; training them to control components of their disease on their own (measure blood glucose levels, blood pressure, body weight regularly, measure waist and hips, monitor their well-being); avoidance of social isolation and loneliness.

- **Family education.** Due to the possibility of cognitive impairment in the elderly or disability resulting from another somatic pathological condition, families need to be taught to inform their ill relatives about the risks of non-compliance with physical activity and the principles of healthy nutrition. They have to motivate, remind them of corrective measures, help them in forming a diet, assist in performing exercises, encourage them to perform independently household and professional activities, control their hygiene.

- **Elements of occupation therapy** refer to the organisation of safe living conditions (the selection of proper furniture height and ensuring its stability; the installation of handrails; the use of non-slip atraumatic coating; the removal of thresholds where possible; sufficient lighting; contrasting markings on stairs; the selection of stability shoes to prevent falls, choosing mobility aids – if necessary);

- **Elements of cognitive training** presuppose the control of memorising tasks from previous classes; encouragement to communicate with family, friends, the

inclusion of poems and songs memorization in the short- and long-term goals of rehabilitation; solving crossword puzzles and logic problems; painting; playing musical instruments; computer games, etc.

Kinesiophobia was determined by Tampa Kinesiophobia Scale (TKS) [16]. The physical functioning parameters of the examined patients was assessed by the Fullerton Fitness Test – FFT (Senior Fitness Test) [17] and Edmonton Frail Scale [18]. The condition of the patients from the main group was evaluated in the dynamics before (pre-test) and after (post-test) implementing the developed program of physical therapy (an annual observation period for the patients of the MG1).

The study was conducted taking into account the principles of the Helsinki Declaration of the World Medical Association «Ethical principles of medical research involving a person as an object of research». Informed consent to participate in the study was obtained from all persons included in the study. The research protocol was discussed and approved at the meeting of the Bioethics Commission of Vasyl Stefanyk Precarpathian National University.

Generalization of the studied characteristics was assessed using arithmetic value (M) and standard deviation (m). Confidence of differences between mean values was assessed by Student's t-criterion. Assessment of statistical hypotheses was based on a 5% significance level. For statistical data processing, Statistica 10 (StatSoft). was used.

## RESULTS

The low level of physical qualities of the elderly with sarcopenic obesity, which was determined by FFT during the initial examination in both gender groups. FFT is a functional test of flexibility, strength, agility and dynamic balance, which indicates involuntal changes in motor skills of elderly and senile people, provides specific information about the physical strengths and weaknesses of the patient related to functional tasks for everyday life (table 1).

When determining frailty domains according to the Edmonton Frail Scale, it was found that elderly people with sarcopenic obesity showed signs of frailty at a mild level (table 2); the lag from CG indicators was more than double in the main groups.

The consequence of the presence of muscle weakness, uncertainty during simple movements, was a high level of kinesiophobia – almost twice as much compared to CG ( $p < 0.05$ ) (Fig. 1). The presence of fear associated with movements increases the risk of falling due to detraining, negatively affects physical qualities and the condition of muscle tissue in people of older age groups [12, 16].

Table 1

**The dynamics of FFT results in the elderly with sarcopenic obesity under the influence of a physical therapy program**

Test exercise FFT	CG (n=34)		MG1 (n=31)				MG2 (n=41)			
			pre-test		post-test		pre-test		post-test	
	M	m	M	m	M	m	M	m	M	m
Chair stand (no. of stands)										
Men	15,85	0,16	7,13*	0,22	6,88*	0,19	7,21*	0,37	15,57°●	0,31
Women	14,88	0,31	7,61*	0,14	7,11*	0,17	7,23*	0,15	15,04°●	0,24
Arm Curl (no. of reps)										
Men	17,52	0,23	8,46*	0,34	8,11*	0,27	8,53*	0,21	16,74°●	0,15
Women	15,74	0,26	7,66*	0,21	7,35*	0,34	8,03*	0,45	16,05°●	0,19
2-Min Step (no. of steps)										
Men	108,33	5,45	60,33	1,16	63,15	2,07	59,84	2,30	100,52°●	4,22
Women	98,57	3,15	59,18*	2,40	60,74*	4,31	57,22*	3,52	93,43°●	2,11
Chair Sit-&-Reach (inches +/-)										
Men	1,95	0,06	3,85*	0,18	3,72*	0,22	3,77*	0,27	2,08°●	0,17
Women	2,49	0,09	4,91*	0,04	5,04*	0,06	4,97*	0,05	2,56°●	0,16
Back Scratch (inches +/-)										
Men	-1,91	0,07	-10,28*	0,24	-10,12*	0,18	-10,44*	0,35	-6,42*°●	0,11
Women	-2,48	0,05	-4,37*	0,08	-4,42*	0,05	-4,45*	0,07	-2,51°●	0,04
8-Foot Up-&-Go (seconds)										
Men	5,13	0,08	9,06*	0,15	9,29*	0,14	9,12*	0,13	5,09°●	0,10
Women	5,26	0,17	9,61*	0,12	9,73*	0,15	9,48*	0,13	5,32°●	0,09

Notes (here and later in the text): \* –  $p < 0,05$  – level of reliability of changes between the indicators of the CG and the MG;

° –  $p < 0,05$  – level of reliability of changes between the indicators of pre-test and post-test;

● –  $p < 0,05$  – level of reliability of changes between the indicators of the MG1 and the MG2

Table 2

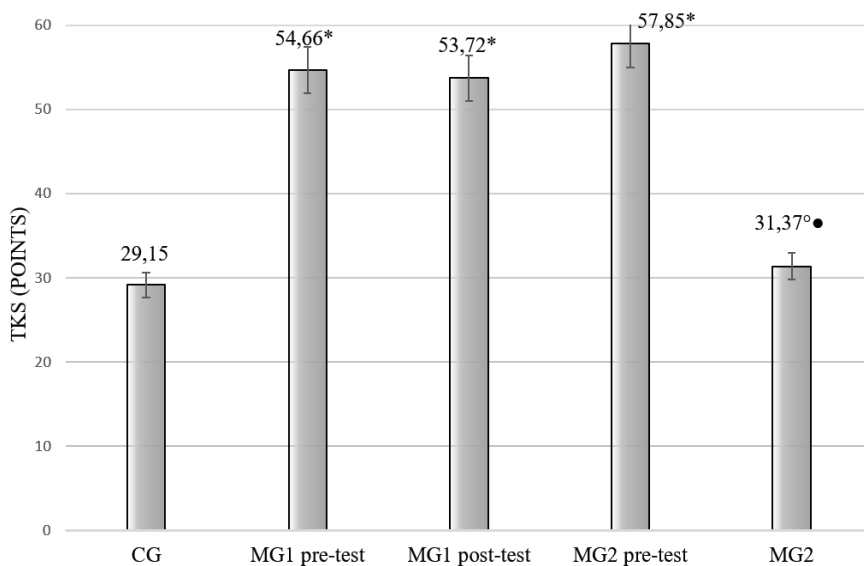
**The dynamics of Edmonton Frail Scale results in the elderly with sarcopenic obesity under the influence of a physical therapy program**

Test exercise FFT	CG (n=34)		MG1 (n=31)				MG2 (n=41)			
			pre-test		post-test		post-test		pre-test	
	M	m	M	m	M	m	M	m	M	m
Cognition	0,38	0,08	0,50	0,09	0,56	0,09	0,54	0,08	0,49	0,08
General health status	0,79	0,12	1,75*	0,11	1,84*	0,12	1,73*	0,11	1,29*°●	0,10
Functional independence	0,68	0,08	1,81*	0,12	1,94*	0,12	1,85*	0,09	1,27*°●	0,12
Social support	0,32	0,0	0,78*	0,10	0,84*	0,10	0,68*	0,09	0,71*°●	0,08
Medication use	0,56	0,13	0,94*	0,08	1,03*	0,09	0,85*	0,08	0,63°●	0,08
Nutrition	0,24	0,07	0,59*	0,09	0,63*	0,09	0,63*	0,8	0,34°●	0,07
Mood	0,35	0,08	0,69*	0,08	0,78*	0,07	0,78*	0,06	0,39°●	0,08
Continence	0,21	0,07	0,47*	0,09	0,53*	0,09	0,5*6	0,08	0,32°●	0,07
Functional performance	0,47	0,09	1,50*	0,09	1,53*	0,09	1,44*	0,08	1,20*°●	0,09
Totals	4,00	0,26	9,03*	0,29	9,69*	0,32	9,07*	0,26	6,63*°●	0,29

According to the results of the initial examination, the representatives of the main groups did not differ from each other ( $p > 0,05$ ), i.e. were comparable. This made it possible to conduct the following study aimed at correcting the identified functional disorders.

The use of active methods (kinesitherapy) in the the developed program of physical therapy led to the restoration of the physical qualities of the MG2 representatives. This was manifested in a statistically significant improvement ( $p < 0,05$ ) in the results of performing all FFT exercises in the men and women in relation to the initial indicator and the corresponding

result of the MG1 (table 1). The result of the «Chair stand» test improved in the men from the MG2 by 116%, in the women – by 109,4%. The parameters of the «Arm Curl» test improved in the men from the MG2 by 96.2%, in the women – by 99.9%. The results of the «2-Min Step» exercise increased in the men from the MG2 by 68% and in the women – by 63.3%. The parameters of the «Chair Sit-&-Reach» test improved in the men of the MG2 by 44.8%, in the women – by 48.5%. The repeated results of the «Back Scratch» test improved in the men from the MG2 by 38.5%, in the women – by 43.6%. The results of the «8-Ft Up-&-Go» test in the men of the MG2 improved by 44.2%, in the women – by 43.9%.



**Figure 1. Dynamics of the level of kinesiophobia according to TKS in elderly people with sarcopenic obesity under the influence of a physical therapy program**

The reduction in the level of frailty according to the Edmonton Frail Scale in MG2 was 26.9% compared to the initial level, which indicated an improvement in confidence in one's movements, a decrease in muscle weakness (table 2).

Improvement of motor control and physical qualities, self-confidence, learning the principles of safe motor activity led to a reduction of kinesiophobia according to the TKS (Fig. 1) in MG2 by 48.5% compared to the initial level ( $p < 0,05$ ).

During the re-examination of the MG1 individuals, who were characterised by a low level of the therapeutic alliance, it was found that the positive dynamics in their condition for all the studied indicators did not occur ( $p > 0.05$  relative to the initial data). This indicates that, despite being aware of the risks of frailty, metabolic syndrome and their combination in the form of sarcopenic obesity, these patients did not follow the recommendations provided or followed them unsystematically or incompletely.

## DISCUSSION

Accordingly, when devising a physical therapy program for elderly patients with sarcopenic obesity, we were guided by the following provisions [1, 2, 5]. It was important to maintain or build muscle mass, maintain physical activity, prevent falls, which is possible only through exercises for improving flexibility, balance and endurance. Kinesitherapy was implemented in the form of individualized programs, which were developed based on the results of the rehabilitation examination, for a long time with its subsequent correction by indefinite continuation. The specificity of rehabilitation programs for the elderly is to take into account the risk of cognitive

dysfunction [2, 4]. We implemented this provision through the elements of cognitive training, occupation therapy, education of patients and their families. Another feature was that the effectiveness of the physical therapy program in the patients with sarcopenic obesity was primarily evaluated on the basis of improved functional activity, without focusing on weight loss, since body mass index is not as important for the correction of sarcopenic obesity as it is for correcting obesity in young people [4, 10].

Given the above, when creating a physical therapy program, we solved several main tasks at the level of International Classification of Functioning, Disability and Health (ICF) domains «Body Function and Structures», «Activity» such as improving the patients' physical status, minimising the risk of falling, improving physical and household activity, reducing abdominal obesity, relieving depression. The main goal of physical therapy in the elderly at the level of the ICF «Participation» domain was achieved by improving the physical qualities and maintaining the mental status of a person with age-related health disorders, and thus contributing to prolonging the active period of life through ensuring the optimal functioning of physical and mental abilities. The application of ICF principles made it possible to formulate individual short- and long-term goals of the physical therapy program at the stage of patient examination, helped to plan and carry out interventions from the standpoint of patient centricity, which contributed to achieving a full restorative effect.

## CONCLUSIONS

1. Elderly people with sarcopenic obesity have a high level of kinesiophobia (Tampa Kinesiophobia Scale), their physical status (coordination, balance,

strength, flexibility, endurance, agility) significantly lags behind that of their peers (Fullerton Fitness Test), they suffer from the frailty (Edmonton Frail Scale).

2. The application of the developed physical therapy program (kinesitherapy, dietary intervention, massage, patient and their family education, the elements of occupation therapy, cognitive training), which takes into account comorbid pathological conditions of the examined elderly patients against a background of a high level of the therapeutic alliance, led to a statistically significant improvement in the investigated parameters of physical status, the indicators of a frailty and kinesiophobia in comparison with the initial indicators.

3. The low level of the therapeutic alliance, despite the awareness of the negative consequences for the health, led to unsatisfactory implementation or non-implementation of the recommendations provided for the elderly with sarcopenic obesity and was associated with

no improvement in the physical status, signs of frailty, kinesiophobia.

Prospects for further research consist in the practical determination of the impact of the physical therapy programs for indicators of basic and instrumental activities of daily living.

### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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*Резюме***ДИНАМІКА КІНЕЗІОФОБІЇ ТА ПАРАМЕТРІВ ФІЗИЧНОГО ФУНКЦІОНУВАННЯ У ОСІБ ПОХИЛОГО ВІКУ ІЗ САРКОПЕНІЧНИМ ОЖИРІННЯМ ПІД ВПЛИВОМ ПРОГРАМИ ФІЗИЧНОЇ ТЕРАПІЇ****Назар П. Коваль, Марія Г. Аравіцька**

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**Мета:** визначити ефективність програми фізичної терапії для осіб похилого віку з саркопенічним ожирінням за показником кінезіофобії та параметрами фізичного функціонування.

**Матеріали та методи.** Обстежено 106 людей похилого віку, яких було розподілено на 3 групи. Контрольну групу склали особи з нормальною масою тіла, які не мали саркопенії. Основна група 1 складалася з осіб із саркопенічним ожирінням та слабким терапевтичним альянсом; їм було надано загальні рекомендації щодо корекції режиму харчування та розширення фізичної активності. До основної групи 2 увійшли пацієнти з високим терапевтичним альянсом. Для них була розроблена річна програма фізичної терапії з використанням кінезотерапії, масажу, дієтичного втручання, навчання пацієнтів, елементів когнітивного тренінгу та ерготерапії. Динаміку оцінювали за Tampa Kinesiophobia Scale, Fullerton Fitness Test, Edmonton Frail Scale.

**Результати:** Особи похилого віку з саркопенічним ожирінням мали високий рівень кінезіофобії (Tampa Kinesiophobia Scale), їх фізичний стан (координація, рівновага, сила, гнучкість, витривалість, спритність) значно відставав від своїх однолітків (Fullerton Fitness Test), визначалась фізична астения (Edmonton Frail Scale). Після застосування розробленої програми фізичної терапії можна констатувати, що в осіб основної групи 2 спостерігалось статистично достовірне ( $p < 0,05$ ) покращення показників фізичної активності відносно показників однолітків та вихідних параметрів, зменшення слабкості, зниження рівня кінезіофобії. Низький рівень терапевтичного альянсу, незважаючи на усвідомлення негативних наслідків для здоров'я, призводив до незадовільного виконання або невиконання рекомендацій, наданих людям похилого віку з саркопенічним ожирінням, і був пов'язаний з відсутністю покращення фізичного стану, ознаками слабкості, кінезіофобією.

**Висновки.** Розроблена програма фізичної терапії для пацієнтів похилого віку з саркопенічним ожирінням на фоні високого рівня терапевтичного альянсу показала статистично значуще покращення всіх досліджуваних показників кінезіофобії та фізичного функціонування порівняно з вихідним рівнем та показниками осіб з низьким рівнем терапевтичного альянсу.

**Ключові слова:** фізична терапія, стареча астения, похилий вік, саркопенічне ожиріння, метаболічний синдром.