

Received: 30.10.2023/ Accepted: 28.11.2023/ Published online: 29.12.2023

УДК 616-08-039.71, 616-084

[DOI 10.53511/PHARMKAZ.2024.58.58.001](https://doi.org/10.53511/PHARMKAZ.2024.58.58.001)

M. BAIBOLOVA<sup>1</sup>, B.A BOLATBEKOV<sup>1,2,4</sup>, K.S. TRUSHEVA<sup>1</sup>, S. KURAMYS<sup>2,3,4</sup>, Z.S BOLATBEKOVA<sup>2</sup>, B. YESENBEKOV<sup>1</sup>

<sup>1</sup> International Kazakh-Turkish University, Turkestan, Republic of Kazakhstan

<sup>2</sup> Clinic CardioMed, Shymkent city, Republic of Kazakhstan

<sup>3</sup> Al-Farabi Kazakh National University, Almaty, Republic of Kazakhstan

<sup>4</sup> South Kazakhstan Medical Academy, Shymkent, Republic of Kazakhstan

## COMPARATIVE EVALUATION OF CARDIOREHABILITATION EXERCISES AFTER OPEN HEART SURGERY SUMMARY

**Resume.** Cardiorehabilitation is a well-established treatment model developed worldwide to reduce the burden of cardiovascular disease. Cardiorehabilitation is a complex method, as it includes many components. As a result, the nature and quality of cardiac rehabilitation services may vary, which in turn affects the degree of benefit to the patient. There are 20 Cardiac Rehabilitation component indicators that are always used. However, whether cardiorehabilitation has been improved to meet these standards is not well characterized. At the same time, it is necessary to evaluate the performance of exercises performed by patients during cardiorehabilitation, and the effectiveness of these exercises.

**The purpose of the study:** to evaluate the performance of exercises during cardiorehabilitation after open heart surgery and to evaluate their clinical effectiveness.

**Methods.** Based on the selection criteria for the study, patients were selected who were admitted to the rehabilitation department of the Cardiomed clinic through the Hospitalization Bureau after open heart surgery. A total of 104 patients participated in this study. A comprehensive program of cardiorehabilitation at the 2nd and 3rd stages of rehabilitation in the patients after open heart surgery consists of breathing simulators, physical exercises, physiotherapy, exercise bike, inhalations, breathing exercises, a treadmill or skis. All patients receive medical treatment + rehabilitation procedures according to the developed cardiorehabilitation program. To assess the results of the study, the Borg scale (a widely used quantitative measure of perceived exertion during physical activity) was measured in points, and exercise duration was measured in minutes. The 6-minute walk test was used to describe exercise effectiveness and exercise tolerance.

**Results.** The average age of patients was  $51.96 \pm 1.13$  years, including 65.4% of men and 34.6% of women. Among comorbidities, 67.3% of patients have arterial hypertension. Coronary artery bypass grafting was performed on the 42.3% of patients, mammary coronary artery bypass grafting on the 12.5% patients, mitral valve replacement on the 26.9% patients, aortic valve replacement on the 11.5% patients, mitral aortic graft on the 4.9% patients and correction of congenital heart defects on the 1.9% patients. As the results of the study it revealed, that light intensity during physical activity before rehabilitation was less, and high intensity was greater; after 6 months, exercises were easily performed in more than half of the patients. In addition, over time, the exercise became easier, and the overall duration increased. According to the results of the 6-minute walk test, the distance that patients walk has increased, so the result of cardiorehabilitation treatment is obvious better.

**Conclusion:** according to the results of the study, the exercises performed during cardiorehabilitation are easy, voluminous and doable, and the improvement of the 6-minute walk test indicates the effectiveness of the exercises.

**Key words:** cardiorehabilitation, exercises, open heart surgery, coronary artery bypass grafting, Borg scale.

М. БАЙБОЛОВА<sup>1</sup>, Б.А БОЛАТБЕКОВ<sup>1,2,4</sup>, К.С.ТРУШЕВА<sup>1</sup>,  
С.ҚҰРАМИС<sup>2,3,4</sup>, З.С.БОЛАТБЕКОВА<sup>2</sup>, Б.ЕСЕНБЕКОВ<sup>1</sup>

<sup>1</sup> Халықаралық Қазақ-Түрік Университеті Түркістан қаласы, Қазақстан Республикасы

<sup>2</sup> КардиоМед Клиникасы, Шымкент қаласы, Қазақстан Республикасы

<sup>3</sup> Аль-Фараби атындағы Қазақ Ұлттық Университет, Алматы қаласы, Қазақстан Республикасы

<sup>4</sup> Оңтүстік Қазақстан Медицина академиясы, Шымкент қаласы, Қазақстан Республикасы

## ЖҮРЕККЕ АШЫҚ ОТАДАН КЕЙІНГІ КАРДИОРЕАБИЛИТАЦИЯ ЖАТТЫҒУЛАРДЫҢ ОРЫНДАЛУЫН САЛЫСТЫРМАЛЫ БАҒАЛАУ

**Түйін:** Кардиореабилитация - бүкіл әлемде жүрек-қан тамырлары ауруларының ауырталығын жеңілдету үшін әзірленген медициналық көмектің нақты қалыптасқан үлгісі. Кардиореабилитация көп компонентті болғандықтан кешенді әдіс болып табылады. Осыған орай Кардиореабилитация қызметтерінің сипаты мен сапасы әр түрлі болуы мүмкін, бұл өз кезегінде емделуші үшін пайда дәрежесіне әсер етеді. Әрдайым қолданыстағы Кардиореабилитация компоненттерінің 20 индикаторы бар. Бірақ, Кардиореабилитация осы стандарттарға сәйкес нақтыланған ба, жоқ па, ол жеткілікті түрде сипатталмаған. Сонымен қатар кардиореабилитация кзінде жасалынатын жаттығулардың науқастар орындаулы мен сол жаттығулардың эффективтілігін бағалау қажет болып табылады.

**Зерттеу мақсаты:** Жүрекке ашық отадан кейінгі кардиореабилитация кезінде жасалынатын жаттығулардың орындалуын бағалау және клиникалық эффективтілігін бағалау

**Әдістер:** Зерттеуге жүрекке ашық отадан кейінгі госпитализациялау бюросымен КардиоМед клиникасының оңалту бөліміне стационарға іріктеу критерийлеріне байланысты жатқызылған науқастар таңдалынды. Жалпы зерттеуге 104 науқас қатысты. Ашық жүрекке отадан кейін науқастарды стационарлық оңалтудың 2-ші және 3-ші сатыларына арналған кешенді кардиореабилитация бағдарламасы тыныс алу тренажерларынан, дене жаттығуларынан, негізгі және соңғы бөлімдерден, жергілікті ультракүлгін сәулеленуден, велотренажерден, ингаляциядан, тыныс алу жаттығуларынан, жүгіру жолынан немесе шаңғы тебуден тұрады. Барлық пациенттер әзірленген кардиореабилитация бағдарламасына сәйкес дәрі-дәрмекпен емдеу + оңалту рәсімдерін алатын болады. Зерттеу нәтижелерін бағалау үшін физикалық белсенділік кезінде қабылданған жүктеменің жиі қолданылатын сандық өлшемі болып табылатын Борг шкаласы баллмен және жаттығулардың ұзақтығы минутпен өлшенді. Жаттығулар эффективтілігін физикалық белсенділікке тәзімділікті сипаттайтын 6 минуттық жаяу жүру тесті қолданылады.

**Нәтижелері:** Науқастардың орташа жасы 51,96±1,13 жыл, ішінде 65,4% ерлер және 34,6% әйелдер. Қосымша аурулар ішінде Артериальная Гипертония 67,3% науқаста. Жалпы оталар бойынша Аорто-Коронарлы Шунттеу 42,3%, Маммаро-Коронарлы Шунттеу 12,5%, Митралды қақпақша протездеуі 26,9%, Аорталды қақпақша протездеуі 11,5%, Митральды-аорталық протездеуі 4,9%, Туа біткен жүрек ақауларын түзетуі 1,9%. Зерттеу нәтижелерінде көрсетілгендей физикалық жүктеме кезіндегі жеңіл қар-

М.БАЙБОЛОВА<sup>1</sup>, Б.А БОЛАТБЕКОВ<sup>1,2,4</sup>, К.С.ТРУШЕВА<sup>1</sup>,  
С.КУРАМИС<sup>2,3,4</sup>, З.С.БОЛАТБЕКОВА<sup>2</sup>, Б.ЕСЕНБЕКОВ<sup>1</sup>

<sup>1</sup> Международный казахско-турецкий университет, город Туркестан, Республика Казахстан

<sup>2</sup> Клиника КардиоМед, город Шымкент, Республика Казахстан

<sup>3</sup> Казахский национальный университет имени Аль-Фараби, город Алматы, Республика Казахстан

<sup>4</sup> Южно-Казахстанская медицинская академия, город Шымкент, Республика Казахстан

## СРАВНИТЕЛЬНАЯ ОЦЕНКА КАРДИОРЕАБИЛИТАЦИОННЫХ УПРАЖНЕНИЙ ПОСЛЕ ОТКРЫТЫХ ОПЕРАЦИЙ НА СЕРДЦЕ

**Резюме.** Кардиореабилитация — хорошо зарекомендовавшая себя модель лечения, разработанная во всем мире для облегчения бремени сердечно-сосудистых заболеваний. Кардиореабилитация является комплексным методом, так как включает в себя множество компонентов. В связи с этим характер и качество кардиореабилитационных услуг могут различаться, что, в свою очередь, влияет на степень пользы для пациента. Есть 20 индикаторов компонентов Кардиореабилитации, которые всегда используются. Однако, была ли кардиореабилитация усовершенствована в соответствии с этими стандартами, недостаточно охарактеризовано. При этом необходимо оценивать выполнение упражнений, выполняемых больными в течение кардиореабилитации, и эффективность этих упражнений.

**Цель исследования:** оценить выполнение упражнений при кардиореабилитации после операций на открытом сердце и оценить их клиническую эффективность.

**Методы.** На основании критериев отбора для исследования были отобраны пациенты, поступившие в реабилитационное отделение клиники «КардиоМед» через Бюро госпитализации после операции на открытом сердце. Всего в исследовании приняли участие 104 пациента. Комплексная программа кардиореабилитации на 2-м и 3-м этапах стационарной реабилитации больных после операций на открытом сердце состоит из дыхательных тренажеров, физических упражнений, физиолечения, велотренажера, ингаляций, дыхательных упражнений, беговой дорожки или лыж. Все пациенты будут получать медикаментозное лечение+реабилитационные процедуры согласно разработанной программе кардиореабилитации. Для оценки результатов исследования шкалы Борга, широко используемая количественная мера воспринимаемой нагрузки во время физической активности, измерялась в баллах, а продолжительность упражнения — в минутах. Тест 6-минутной ходьбы использовался для описания эффективности упражнений и толерантности к физической нагрузке.

**Результаты.** Средний возраст больных составил 51,96±1,13 года, в том числе 65,4% мужчин и 34,6% женщин. Среди сопутствующих заболеваний у 67,3% больных имеется артериальная гипертония. Аорто-коронарное шунтирование 42,3%, маммаро-коронарное шунтирование 12,5%, протезирование митрального клапана 26,9%, протезирование аортального клапана 11,5%, митрально-аортальный протез 4,9%, коррекция врожденных пороков сердца 1,9%. Как показали результаты исследования, легкая интенсивность при физических нагрузках до реабилитации

қынды орындалу оңалтуға дейін аз болып, жоғары қарқындылық көп болса, 6 айдан соң жаттығуларды орындау науқастардың жартысынан көбінде жеңіл орындалады. Сонымен қатар, уақыт өте келе жаттығу жеңіл орындалып, жалпы ұзақтығы созылды. 6 минуттық жаяу жүру тесті нәтижелері бойынша ем нәтижесі жақсы болғаны айқындалып тұр, науқастар жүрген ара қашықтық ұлғайған, демек кардиореабилитация ем нәтижесі айқын.

**Қорытынды:** Жасалған зерттеу нәтижесі бойынша кардиореабилитация кезінде жасалынатын жаттығулар орындалуы жеңіл, ауқымды және орындамалы болып табылады, сонымен қатар 6 минуттық жаяу жүру тесті жақсаруы жаттығулар эффективтілігін көрсетеді

**Түйінді сөздер:** кардиореабилитация, жаттығулар, жүрекке ашық ота, аорто-коронарлы шунттеу, Борг шкаласы.

**Introduction.** Heart disease is the leading cause of death worldwide, and Kazakhstan is no exception. According to WHO data, mortality from myocardial infarction in the whole world is 31%, and according to the data of the Republican Center for Healthcare Development in Kazakhstan, it is 23%; also, morbidity from circulatory system diseases increased by 5.9% in 2020 compared to 2019, and death by 18.2%. [1-3]. Several societies and organizations have developed clinical recommendations for managing Coronary Artery Diseases (CAD). The general goals of treatment in these guidelines are symptom relief (with medication and revascularization) and prevention of future cardiovascular events. Cardiac rehabilitation is one of the optimal methods of prevention. Cardiac rehabilitation (CR) is a well-established model of care designed to reduce the burden of cardiovascular disease (CVD) worldwide. CR is a complex method as it has many components. In this regard, the nature and quality of CR services may differ, which in turn affects the degree of benefit for the patient. CR quality indicators or performance indicators are approved by different CR societies. There are 20 indicators of CR components that are always available [4]. However, whether CR is specified according to these standards or not, it is not sufficiently described. At the same time, it is necessary to evaluate the performance of the exercises of cardiorehabilitation performed by the patients during the in-hospital staying and the effectiveness of those exercises.

**Research purpose:** Assessment of exercise performance and clinical effectiveness during CR in patients after open heart surgery

#### Methods and materials

Subject of the study: Patients admitted to the rehabilitation department of the Cardiomed clinic (place of the study was made – Republic of Kazakhstan, Shymkent city, Kaldayakova street, 38A) by the Bureau of Hospitalization after open heart surgery were selected for the study based on the selection criteria. Study design - prospective comparative clinical case-control study

104 adult patients over 18 years were participated in the general study, regardless of gender and nationality. Inclu-

сion criteria was hospitalizaion by the portal; the exclusion criterion was the voluntary refusal of the patient. Data collection periods during the study were from the moment of hospitalization to the day of discharge, as well as the follow-up period after 3 and 6 months. The duration of cardiac rehabilitation lasts 14 days during the inpatient stay in the rehabilitation department.

Patients received standard medical therapy, including beta-blockers, AAF inhibitors, diuretics, lipid-lowering therapy, acetylsalicylic acid or other antithrombotic drugs, proton pump inhibitors, and others as indicated. Before the start of the rehabilitation measures, for each patient was given a methodological instruction, which fully describes the rehabilitation program and its structure. Individual rehabilitation cards with clinical and functional research data are created for each patient.

**Primary results of the research:** evaluation of the training (exercises) performed by the patient by their intensity and capacity according to the Borg scale and the duration of the general exercises.

**Secondary research findings:** The 6-minute walk test demonstrates the effectiveness of exercises.

#### Data's for achieving primary and secondary results

The Borg scale [5] is a commonly used quantitative measure of perceived exertion during physical activity. The Borg scale is a numerical scale from 6 to 20, where 6 means "absence of tension" and 20 "maximum tension". When measuring, a person chooses a number from the following scale that best describes his level of exertion during physical activity. Physical activity tolerance and effectiveness was assessed with the 6-minute walk (6MWT) test [6] and including count in minutes the duration of training.

The duration of exercises was measured in minutes.

The duration of exercises was measured in minutes.

The duration of exercises was measured in minutes.

The duration of exercises was measured in minutes.

The duration of exercises was measured in minutes.

The duration of exercises was measured in minutes.

The duration of exercises was measured in minutes.

The duration of exercises was measured in minutes.

**Ethically.**

The study was performed in accordance with the relevant clinical practice standards (Good Clinical Practice) and the principles of the Declaration of Helsinki. The research protocol was approved by the ethics committee of the CardioMed clinic. Written informed consent was obtained from all participants about the treatment procedure and possible complications before inclusion in the study.

**Statistical analysis**

Statistical analysis was carried out using Microsoft Excel 2007-2010 software (Microsoft Corp., USA) and statistical software package STATISTICA (StatSoft, USA). Qualitative indicators were presented as absolute frequencies and percentages. Quantitative markers were normally distributed and presented as arithmetic mean  $\pm$  standard deviation (M  $\pm$  SD). Treatment and post-treatment results by numerical signs in cases of deviation or following the normal distribution law was carried out by t-test (Student's test) for unrelated groups. In the case of non-observance of the Law of normal distribution, the comparison of two different groups

according to their quantitative characteristics was carried out according to the Mann-Whitney U-test. Comparison of two different groups according to qualitative characteristics was carried out according to the Pearson test. If comparisons were made between multiple treatments the analysis of variance (ANOVA) was performed under the condition of a normal distribution of quantifications carried out at several stages, which was also used for comparisons of continuous data, and the  $\chi$ -squared measure was used for comparisons of categorical data.

All reported values at  $p < 0.05$  were considered significant.

**Results**

According to the general characteristics shown in Table-1, the average age of the patients is 52 years, and the gender is more male. No significant deviations from harmful habits were detected, but revealed the majority of patients suffered from Arterial Hypertension. Among the operations performed on the patient coronary bypass surgery was performed more often.

Table 1 - General description of the patients

Parameter name	Characteristics (n=104)
Age, year M $\pm$ SD	51.96 $\pm$ 1.13
Gender, male, n(%)	68 (65.4%)
female, n(%)	36 (34.6%)
Postoperative period, months M $\pm$ SD	9.46 $\pm$ 1.3
Harmful habits	
Smoking, n(%)	21 (20.2%)
Body mass index, M $\pm$ SD	29.8 $\pm$ 0.47
Additional diseases	
Artrial Hypertension , n(%)	70 (67.3%)
Diabetes mellitus type 2, n(%)	23 (22.1%)
Including those taking insulin, n(%)	19 (18.3%)
Surgery	
Coronary artery bypass grafting, n (%)	44 (42.3)
By shunted coronary arteries:	
R. interventricularis anterior , n(%)	23 (52)
R. circumflexus n(%)	12 (27)
Coronary artery dextra , n (%)	16 (36)
Mammaro-Coronary Shunt n( % )	13 (12.5)
Mitral valve prosthesis , n ( % )	28 (26.9)
Aortic valve prosthesis, n(%)	12 (11.5)
Mitral-aortic prosthesis n(%)	5 (4.9)
Correction of congenital heart defects n(%)	2 (1.9)
All performed surgeries are assessed by the EuroScore II scale depending on risk	
low risk ( <4% ) , n (%)	25(24)
average risk ( 4-10% ) , n (%)	64(61.5)
high risk ( >10% ) , n (%)	15(14.5)

**MAIN (PRIMARY) RESULTS OF THE STUDY**

As shown in Table-2, light intensity during physical training was less before CR, and high intensity became more after 6 months. And more than half of the patients can easily perform exercises after 3-6 months.

According to the results of Table-3, exercises performing time became longer and the total duration increased, due to the performance of the exercises.

**ADDITIONAL (SECONDARY) RESULTS OF THE STUDY**

Based on the numbers shown in Table-4, it is clear that the treatment result is good, the distance between the period had increased, so the result of cardio-rehabilitation exercises was effective.

Assessment of the risk ratio

1. The degree of risk was low because the likelihood and magnitude of harm or discomfort expected in research was no greater than that encountered in everyday life or during routine physical or psychological testing. Potential risk or discomfort was minimized, but risk exists in this category of research; because extreme physical activity can cause recurrent myocardial ischemia and chest pain.

2. Risk protection. In order to reduce complications and risks, the researcher monitored the patient daily: the daily pain level, Blood pressure and heart rhythm were measured, and if necessary, electrocardiographic, echocardiography, X-rays were performed; if any (clinical complaints-especially sternal pains, etc.), objective (Blood pressure and heart rhythm changes) or electrocardiographic (ST depression  $\geq 1$  mm) criteria appeared, the

researcher immediately stopped or slowed down the activity of exercises.

**Discussion**

Complications of coronary heart disease (CHD) are varied and mortality is a potential reality. Cardiac rehabilitation (CR) is a non-invasive therapy in the prevention of CAD complications with risk factor modification tactics that reduce mortality and morbidity. CR participants show good physical training results and psychological benefits. Although referral to CR is a Class 1A recommendation after myocardial infarction, the programs are underused. Mortality and morbidity are two outcomes studied to determine the effectiveness of CR services. Considered a secondary health prevention intervention, CR is associated with reductions in mortality and morbidity. In two seminal works published three decades ago, a 20% to 25% reduction in mortality was observed. Different societies and associations have proposed different cardiac rehabilitation programs and all of them meet professional standards [7]. Barriers to performing CR in resource-limited settings tend to match those found in high-resource settings. However, under such conditions, the obstacles encountered are more difficult to overcome, since the CR procedure is so new that many experts ask for more information about the nature of the CR and especially the performance of the exercise. From a social point of view, professionals and patients prioritize drug emergency care, despite the obvious benefits of CR [8]. After integration of all results, suitable strategies to overcome key barriers should be identified using evidence and expert opinion. Implementation

Table 2 - Assessment of physical intensity according to the Borg scale

Borga scale during physical exertion	15-20 points	11-15 points	6-10 points
	Light intensity	Average intensity	High intensity
Before cardiac rehabilitation	11%	24%	65%
After cardiac rehabilitation	16%	31%	53%
After 3 months	36%	20%	44%
After 6 months	51%	37%	12%

Table 3 - The duration of exercises performing time in minutes

Period	Average	Average error	Standard deviation
On the 1st day	2,7587	0,10403	1,06092
On the last day	9,6096	0,13062	1,33202
After 3 months	17,7085	0,17571	1,79193
After 6 months	24,1923	0,24100	2,45771

Table 4 - Dynamics of the 6-minute walk test

Period	In patients
Date of descent, m M $\pm$ SD	243.5385 $\pm$ 43.78853 ( DI 122.00 : 338.00 ; CI 4.29382 )
Last day, m M $\pm$ SD	309.6442 $\pm$ 44.80940 ( DI 192.00 : 408.00 ; CI 4.39392 )
After 3 months, m M $\pm$ SD	386.6923 $\pm$ 49.44234 ( DI 224.00: 452.00; CI 4.84822)
After 6 months, m M $\pm$ SD	413.0962 $\pm$ 49.40589 ( DI 248.00 : 480.00 ; CI 4.84465 )
p	0.000235

impact on CR utilization should be measured [9]. Polypharmacy is common in patients undergoing CR, especially in the elderly, where it can affect rehabilitative physical activity. Despite this, the relationship between medications, illness, physical activity, and rehabilitation outcomes is not well understood. In their study, Ljungqvist O et al identified common classes of drugs that can affect physical activity levels and rehabilitation outcomes, especially drugs that improve disease progression and improve exercise-restricting symptoms (eg, shortness of breath in heart failure and lung disease, pain in arthritis), unwanted drug side effects (eg, dementia, poor sleep), and classes of drugs that may have the ability to improve activity and rehabilitation outcomes through beneficial effects on neuromuscular function (eg, angiotensin-converting enzyme inhibitors) [10]. Escalante-Gonzalbo AM et al conducted an exercise study in 40 rehabilitation sessions twice a week for 20 weeks. Their experience with the platform was documented with a Likert scale survey. Changes in motor function were assessed using the Chedoke Arm and Hand Activity Scale (CAHAI) and the Wolff Motor Function Test (WMFT). As a result, all participants noted that they felt comfortable using the platform, 6MWT improved (as in our study) [11]. Feier Song et al. retrospectively conducted a study of patients undergoing open aortic valve surgery. The CR program consisted of exercise for 3 months after surgery, while the control group received normal care without exercise. Cardiac rehabilitation was seen to have a beneficial effect on peak oxygen consumption compared to controls (24.2 ml/kg/min vs 20.6 ml/kg/min) as measured by cardiopulmonary exercise test 3 months after surgery [12]. The authors of the meta-analysis found that prehabilitation may improve surgical outcomes in patients undergoing major abdominal and cardiothoracic surgery, according to the following study results: 5921 patients underwent prehabilitation in 61 studies, of which 35 studies (n = 3402) were in the field of major abdominal surgery and 26 studies were in cardiothoracic surgery (n = 2519). Only 45 studies com-

pared the effects of prehabilitation versus no prehabilitation on postoperative outcomes (abdominal, n = 26; cardiothoracic, n = 19). The quality of evidence for prehabilitation for major abdominal and cardiothoracic surgery is similar. Patients receiving prehabilitation before major abdominal surgery have significantly lower rates of total (n = 10, odds ratio: 0.61, 95% confidence interval: 0.43–0.86, P = 0.005), pulmonary (n = 15, odds ratio: 0.41, significance) 95% interval: 0.25–0.67, P < 0.001) and cardiac complications (n = 4, odds ratio: 0.46, 95% confidence interval: 0.22–0.96, P=0.044) [13]. Today, modern data suggests adding isometric and dynamic exercises to increase muscle mass. Also, vigorous physical activity may have a greater effect on cardiovascular morbidity and mortality than moderate physical activity, an effect independent of energy intake. Many studies have shown that physically active patients with cardiovascular disease have a lower risk of cardiovascular death and reduce the risk by up to 35% [14].

CR programs based on systematic physical exercise for patients primarily after acute myocardial infarction, percutaneous coronary intervention, coronary artery bypass grafting have improved the quality of life of patients with heart failure and also increased the standard of living.

Limitations of the study

Exercises performed during cardiorehabilitation are easy and effective, and it would be an additional advantage to determine the quality of life.

Conclusion

According to the results of the study, the exercises performed during cardiorehabilitation are easy, voluminous and doable, and the improvement of the 6-minute walk test indicates the effectiveness of the exercises.

Source of funds

Research and publication of the article was carried out at the expense of the authors' personal funds

Conflict of interest

The authors of this article have confirmed no conflicts of interest.

## REFERENCES

- 1 Abseitova, S, Nursaitova, A, Ahmalieva, A, Akimbaeva, Zh Organizaciya pomoshchi i iskhody ostrogo koronarnogo sindroma po itogam 2015 goda. In Materialy Respublikanskoj nauchno-prakticheskoy konferencii «Integrirovannaya model' upravleniya ostrym infarktom miokarda» 2016 (pp. 6–10).
- 2 Mukanova G, Andosov, D, Ob organizacii pomoshchi pri infarkte miokarda v usloviyah razvitiya ekstrennoj kardiologicheskoy intervencionnoj sluzhby In Materialy Respublikanskoj nauchno-prakticheskoy konferencii «Integrirovannaya model' upravleniya ostrym infarktom miokarda» 2016 (pp. 22–23).
- 3 Pivina, L, Belikhina, T, Markabayeva, A, Zhunussova, T, others. "Medical and social problem of cardiovascular diseases in Kazakhstan". Nauka i zdavoohranenie 2015(2):50–59.
- 4 Baibolova, M, Baimaganbetov, A, Zhanabaev, N, Kuramys, S, Bolatbekova, Z, Bolatbekov, B. "Kardioreabilitaciya-vzglyady na faktory riska i primenenie programm". Vestnik Kazahskogo Nacional'nogo medicinskogo universiteta 2020(1):87–90.
- 5 Borg, G. "Psychophysical bases of perceived exertion". Medicine and science in sports and exercise 1982; 14(5):377–381.
- 6 Yasud, M, Songsaengrit, B, others. "Factors affecting distance of 6-minute walk test in post cardiovascular surgery patients after discharge at Queen Sirikit Heart Center of the Northeast". Srinagarind Medical Journal 2020; 35(6):687–693.
- 7 Graham, H, Lac, A, Lee, H, Benton, M. "Predicting long-term mortality, morbidity, and survival outcomes following a cardiac event: A cardiac rehabilitation study". Rehabilitation Process and Outcome 2019; 8:1179572719827610.
- 8 Ghanbari-Firoozabadi, M, Mirzaei, M, Nasiriani, K, Hemati, M, Entezari, J, Vafaenasab, M, Grace, S, Jafary, H, Sadrbafighi, S. "Cardiac specialists' perspectives on barriers to cardiac rehabilitation referral and participation in a low-resource setting". Rehabilitation process and outcome 2020; 9:1179572720936648.
- 9 Araujo Pio, C, Chaves, G, Davies, P, Taylor, R, Grace, S. "Interventions to promote patient utilisation of cardiac rehabilitation". Cochrane Database of Systematic Reviews 2019(2).
- 10 Ljungqvist, O, Boer, H, Balfour, A, Fawcett, W, Lobo, D, Nelson, G, Scott, M, Wainwright, T, Demartines, N. "Opportunities and challenges for the next phase of enhanced recovery after surgery: a review". JAMA surgery 2021; 156(8):775–784.

- 11 Escalante-Gonzalbo, A, Raml\irez-Graullera, Y, Pasantes, H, Aguilar-Chalé, J, Sánchez-Castillo, G, Escutia-Macedo, X, Briseño-Soriano, T, Franco-Castro, P, Estrada-Rosales, A, Vázquez-Abundes, S, others. "Safety, feasibility, and acceptability of a new virtual rehabilitation platform: a supervised pilot study". *Rehabilitation Process and Outcome* 2021; 10:11795727211033279.
- 12 Song, F, Zhan, H, Liang, Y, He, X, Guo, L. "Cardiac rehabilitation improved oxygen uptake measured by cardiopulmonary exercise test in patients after aortic valve surgery". *Reviews in Cardiovascular Medicine* 2019; 20(1):47–52.
- 13 Kamarajah, S, Bundred, J, Weblin, J, Tan, B. "Critical appraisal on the impact of preoperative rehabilitation and outcomes after major abdominal and cardiothoracic surgery: a systematic review and meta-analysis". *Surgery* 2020; 167(3):540–549.
- 14 Bloc, S, Alfonsi, P, Belbachir, A, Beaussier, M, Bouvet, L, Campard, S, Campion, S, Cazenave, L, Diemunsch, P, Di Maria, S, others. "Guidelines on perioperative optimization protocol for the adult patient 2023". *Anaesthesia Critical Care & Pain Medicine* 2023; 42(4):101264.

*Information about the authors*

Author: **Moldir Baibolova** - doctoral student; International Kazakh-Turkish University, e-mail - sunny0991@mail.ru, Shymkent, Kazakhstan, cell phone +77075280756.  
 Author: **Berik Bolatbekov** - PhD, International Kazakh-Turkish University, senior lecturer, LLP Cardiomed Clinic, director; e-mail - bekamaika@mail.ru, Shymkent, Kazakhstan, cell phone +77079838325; ORCID ID 0000-0002-0181-7501  
 Author: **Kuramys Serzhan Kuramysuly** - doctoral student; Al-Farabi Kazakh National University; e-mail - kuramys@mail.ru, Almaty, Kazakhstan, cell phone +77021274444; ORCID ID 0009-0008-9928-9866  
 Author: **Kymbat Trushева** - doctoral student; International Kazakh-Turkish University, e-mail – kimo\_1992@mail.ru, Shymkent, Kazakhstan, cell phone +77784929634; ORCID ID 0000-0003-1580-9323.  
 Author: **Bolatbekova Zarina** - master of medicine, LLP Cardiomed Clinic, e-mail – kalp87@mail.ru, Shymkent, Kazakhstan, cell phone +77765050054; ORCID ID 0000-0002-3082-9544  
 Автор: **Berikbay Yessenbekov** - doctoral student; International Kazakh-Turkish University; e-mail – Nekcus85@mail.ru, Shymkent, Kazakhstan, cell phone +77013226699. ORCID ID 0000-0002-5604-8658.

*Сведения об авторах*

Автор: **Байболова Молдир** – докторант; Международный казахско-турецкий университет; e-mail – sunny0991@mail.ru, Шымкент, Казахстан, сот.телефон +77075280756.  
 Автор: **Болатбеков Берик** - PhD, Международный казахско-турецкий университет; ТОО «Клиника КардиоМед», директор; e-mail – bekamaika@mail.ru, Шымкент, Казахстан, сот.телефон +77079838325; ORCID ID 0000-0002-0181-7501  
 Автор: **Курамыс Сержан Курамысулы** - докторант; Казахский национальный университет имени аль-Фараби; электронная почта - kuramys@mail.ru, г. Алматы, Казахстан, сотовый телефон +77021274444; ORCID ID 0009-0008-9928-9866  
 Автор: **Трушева Кымбат** – докторант; Международный казахско-турецкий университет; e-mail – kimo\_1992@mail.ru, Шымкент, Казахстан, сот.телефон +77784929634; ORCID ID 0000-0003-1580-9323  
 Автор: **Болатбекова Зарина** - магистр медицины, ТОО «Клиника КардиоМед», e-mail – kalp87@mail.ru, Шымкент, Казахстан, сот.телефон +77765050054; ORCID ID 0000-0002-3082-9544  
 Автор: **Есенбеков Берикбай** - докторант; Международный казахско-турецкий университет; e-mail – Nekcus85@mail.ru, Шымкент, Казахстан, сот.телефон +77013226699; ORCID ID 0000-0002-5604-8658.

*Авторлар туралы мәлімет*

**Байболова Молдир** – докторант; Халықаралық Қазақ-Түрік Университеті, e-mail – sunny0991@mail.ru, Шымкент, Қазақстан, моб.телефон +77075280756.  
**Болатбеков Берик** - PhD, Халықаралық Қазақ-Түрік Университеті, аға оқытушы, ЖШС КардиоМед Клиникасы, директор; e-mail – bekamaika@mail.ru, Шымкент, Қазақстан, моб.телефон +77079838325; ORCID ID 0000-0002-0181-7501  
**Құрамыс Сержан Құрамысулы** - докторант; Өл-Фараби атындағы Қазақ Ұлттық университеті; e-mail – kuramys@mail.ru, Алматы, Қазақстан, моб.телефон +77021274444; ORCID ID 0009-0008-9928-9866  
**Трушева Кымбат** – докторант; Халықаралық Қазақ-Түрік Университеті, e-mail – kimo\_1992@mail.ru, Шымкент, Қазақстан, моб.телефон +77784929634; ORCID ID 0000-0003-1580-9323  
**Болатбекова Зарина** - медицина магистрі, ЖШС «КардиоМед Клиникасы», e-mail – kalp87@mail.ru, Шымкент, Қазақстан, моб.телефон +77765050054; ORCID ID 0000-0002-3082-9544  
**Есенбеков Берикбай** - докторант; Халықаралық Қазақ-Түрік Университеті, e-mail – Nekcus85@mail.ru, Шымкент, Қазақстан, моб.телефон +77013226699; ORCID ID 0000-0002-5604-8658.

**Вклад авторов.** Все авторы принимали равносильное участие при написании данной статьи.

**Конфликт интересов** – не заявлен.

Данный материал не был заявлен ранее, для публикации в других изданиях и не находится на рассмотрении другими издательствами. При проведении данной работы не было финансирования сторонними организациями и медицинскими представительствами. Финансирование – не проводилось.

**Авторлардың үлесі.** Барлық авторлар осы мақаланы жазуға тең дәрежеде қатысты.

**Мүдделер қақтығысы** – мәлімделген жоқ.

Бұл материал басқа басылымдарда жариялау үшін бұрын мәлімделмеген және басқа басылымдардың қарауына ұсынылмаған. Осы жұмысты жүргізу кезінде сыртқы ұйымдар мен медициналық өкілдіктердің қаржыландыруы жасалған жоқ. Қаржыландыру жүргізілмеді.

**Authors' Contributions.** All authors participated equally in the writing of this article.

**No conflicts of interest** have been declared.

This material has not been previously submitted for publication in other publications and is not under consideration by other publishers. There was no third-party funding or medical representation in the conduct of this work. Funding - no funding was provided.