REPUBLIC OF TÜRKİYE
KIRŞEHİR AHİ EVRAN UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF PHYSICAL THERAPY AND
REHABILITATION

COMPARISON OF EARLY MOBILISATION EXERCISES AND TRADITIONAL PHYSIOTHERAPY FOLLOWING CARDIAC SURGERY ON OLDER PATIENTS

Azhar Hassan MHMOOD

MASTER'S THESIS

KIRŞEHİR / 2024

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Assist. Prof. Dr. İsmail CEYLAN

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ACCEPTANCE AND APPROVAL

Kırşehir Ahi Evran University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Master's Thesis titled "COMPARISON OF EARLY MOBILISATION EXERCISES AND TRADITIONAL PHYSIOTHERAPY FOLLOWING CARDIAC SURGERY ON OLDER PATIENTS" prepared by Azhar Hassan MHMOOD with the number 211211151. It has been accepted as a Master's Thesis in the Department of Physiotherapy and Rehabilitation by the following jury on 26/02/2024.

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THESIS STATEMENT

I declare that all the information in the thesis is obtained and presented within the framework of ethical behavior and academic rules, and in this study, which is prepared in accordance with the thesis writing rules, all kinds of statements that do not belong to me are fully cited to the source of the information.

Azhar Hassan MHMOOD

According to Objects 9/2 and 22/2 of the Graduate Education and Training Regulation published in the Official Gazette dated 20.04.2016; A report in accordance with the criteria determined by the Institute of Health Sciences was obtained by using the plagiarism software program for this postgraduate thesis.

Azhar Hassan MHMOOD

PREFACE

First of all, I thank God, after patiently and diligently completing my study. I dedicate my thesis to my family Especially my dear husband , who have never spared their sacrifice in every period of my life, whose prayers I always felt with me, for the trust and support they have shown in me likewise, I do not forget the invitations of my parents in my scientific career. Thank you from deep of my heart. In addition to being an example to me with the calm and patient attitudes he has shown since the day I started my master's degree and during my master's course, the one who supported me, facilitated my difficulties, his encouragement and his helping for me continuously, and taught me a lot, he was always supports me wherever I go, teaching the most valuable information of my professional and academic life. I would like to thank my esteemed professor, advisor Dr. ISMAIL CEYLAN. I also took the opportunity to express my thanks to my friend RAED AL-JANABI who did not hesitate to advise me on the correction of my work. I would like to thank all my teachers for their efforts in my education who helped, supported me with love, appreciation, advice, direction and guidance from my childhood to this stage.

February 2024 Azhar Hassan MHMOOD

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LIST OF SYMBOLS AND ABBREVIATIONS

AVR: Aortic Valve Repair/Replacement

CRP: Cardiac Rehabilitation Program

CVD: Cardiovascular Disease

CPB: Cardiopulmonary Bypass

CVA: Cerebrovascular Accident

CAD: Coronary Artery Disease

CABG: Coronary Artery Bypass Graft

ECC: Extracorporeal Circulation

MI: Myocardial infarction

MR: Mitral Regurgitation

MVR: Mitral Valve Repair/Replacement

PA: Physical Activity

PCI: Percutaneous Coronary Intervention

SF-IPAQ: Short-Form International Physical Activity Questionnaire

SPPB: Short physical performance battery

TUG: Time up and go

2MWT: Two-minute walk test

ABSTRACT

M.Sc. THESIS

COMPARISON OF EARLY MOBILISATION EXERCISES AND TRADITIONAL PHYSIOTHERAPY FOLLOWING CARDIAC SURGERY ON OLDER PATIENTS

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The cardiovascular system generally consists of the heart and vessels. Heart and blood vessel problems together referred to as cardiovascular diseases (CVD) include congenital heart disease, cerebrovascular illness, and coronary heart disease. It is expected that CVD will remain the leading cause of death and disability in the world moving forward. Numerous issues can affect the cardiovascular system, such as defects in the conduction system, rheumatic heart disease, and endocarditis. CVD is mostly treated with medication, exercise, a balanced diet, and heart surgery. Following heart surgery, patients who are active in the postoperative phase stay in the hospital for shorter periods of time and experience fewer complications.

After cardiac surgery, exercise helps people improve, but insufficient physical activity can make recovery more difficult. When compared to other alternative therapies, early mobilization following a cardiac surgery improves physical function better. However, recent studies suggest that early patient mobility can facilitate oxygen transport and functional recovery, as well as lower postoperative complications and shorter hospital stays. After cardiac surgery, older adults who exercise during the recovery period experience fewer difficulties and hospitalizations. The purpose of this study is to assess the impact of early mobilization and functional exercise on geriatric patients' post-cardiac surgery physical activity, functional status, and balance.

A total of 100 elderly patients—69 men and 31 women—who had undergone cardiac surgery and were up to 65 years old—voluntarily took part in the study. There were fifty patients in each of the two groups that the participants were divided into: the early mobilization group (Group A) and the control group (Group B). While the patients in the control group did not get the therapeutic regimen used in the early mobilization group, the patients in the early mobilization group received early mobilization and a functional exercise program.

This study was conducted at the Ibn Al-Bitar Hospital in Baghdad, Iraq. A program of early mobilization and functional exercises, in which fifty patients participated part, included: within the first two days after surgery in the intensive care unit, the following exercises are performed: head control, good hand grasp, balance while sitting, breathing exercises using spirometry, and postural drainage using cupping vibration massage three times a day. Between the three and seven days after surgery, the following exercises performed: breathing exercises, postural drainage, inspiratory muscle strength, functional exercise (standing and sitting on a chair, walking inward, backward side line, stepping inside the patch, squatting leaning against wall) for four times a day and repeating fifteen times; and supervised walking in increments of two minutes, as tolerated, up to ten minutes in the morning, afternoon, and evening. Every patient's demographic data was recorded on the seventh postoperative day.

In the intensive care unit, the following exercises were performed one to two days after the operation: postural drainage with cupping vibration massage three times a day, head control, good hand grasp, balance while sitting, and movement of the shoulder and neck. Within the first three to seven days following surgery, the following exercises performed: breathing exercises, postural drainage, inspiratory muscle strength, functional exercises (standing and sitting on a chair, walking inward, backward side line, stepping inside the patch, squatting leaning against wall) for four times a day and repeating fifteen times; and supervised walking in increments of two minutes, as tolerated, up to ten minutes in the morning, afternoon, and evening.

On the seventh day following heart surgery, all patients assessed with examinations and questionnaires. To measure physical activity Short-Form International Physical Activity Questionnaire (SF-IPAQ), to assessment balance Time Up and Go (TUG), to assessment functional capacity the 2-minute walking test (2MWT) and the short physical performance battery (SPPB) used.

The purpose of this study is to assess the impact of early mobilization and functional exercise on geriatric patients' who undergone cardiac surgery. Our study's findings indicate that early mobilization and functional exercises have a positive impact on older cardiac patients'. Older patients undergoing cardiac surgery also experienced improved balance as a result of early mobilization and functional exercises.

26 February 2024, 97 Pages

Keywords: Cardiovascular diseases, cardiac surgery, early mobilization, functional exercise, balance, physical activity, functional capacity.

ÖZET

YÜKSEK LİSANS TEZİ

KALP CERRAHİSİ GEÇİRMİŞ YAŞLILARDA ERKEN MOBİLİZASYON VE GELENEKSEL FİZYOTERAPİNİN KARŞILAŞTIRILMASI

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Kardiyovasküler sistem, diğer adıyla dolaşım sistemi kalp ve kan damarlarından oluşur. Bu sistem vasıtasıyla kan tüm vücuda yayılır, oksijen ve besin maddeleri tüm doku ve organlara iletilir. Kardiyovasküler hastalıklar (KVH) koroner kalp hastalığı, serebrovasküler hastalıklar ve konjenital kalp hastalığı gibi bir grup hastalığın genel tanımıdır. KVH'nin etiyolojisi ve patogenezi büyük ölçüde yaşam tarzına bağlıdır. KVH'lerin davranışsal, biyolojik ve sosyal düzeyde yatkınlıkları ve risk faktörleri vardır. Bunlar yaş, cinsiyet, genetik faktörler, diabetes mellitus, hiperlipidemi, obezite, hipertansiyon, sağlıksız beslenme, sigara kullanımı, fiziksel hareketsizlik ve stresli yaşam tarzıdır.

Dünya Sağlık Örgütü (WHO), kan basıncı, kolesterol, obezite ve sigara içiminin kontrolü ile KVH'lerin görülme sıklığının yarıya indirilebileceğini bildirmektedir. Günümüzde yıldan yıla artan KVH'ler mortalite ve morbiditenin başlıca sebeplerindendir. WHO'ya göre, KVH her yıl yaklaşık 17,9 milyon kişinin ölümüne sebebiyet vermekte ve dünyada ölüm nedenleri arasında birinci sırada yer almaktadır. KVH nedeniyle gerçekleşen beş ölümünün dördü kalp krizi ve serebrovasküler olaylardan kaynaklanmakta ve bu ölümlerin üçte biri 70 yaşın altındaki kişilerde gerçekleşmektedir.

Post-operatif dönemde aktif olan hastaların hastanede kalma sürelerinin daha kısa olduğu ve post-operatif komplikasyonlara daha az maruz kaldıkları bilinmektedir. Dünya Sağlık Örgütü'ne göre, tekrarlayan kardiyovasküler olayların %75'i önlenebilmekte ve ikincil koruma bu yükü hafifletebilmektedir. Kardiyak rehabilitasyon (KR), mortaliteyi azaltan ve KVH'li hastaların yaşam kalitesine olumlu etki eden, etkili bir ikincil korunma için tüm klavuz önerileri sunan kapsamlı bir bakım modelidir. Kardiyak rehabilitasyon programları ile KVH'li hastaların, değiştirilebilir risk faktörlerini önleyerek veya ortadan kaldırarak, hastalık öncesi durumlarını yeniden kazanmaları hedeflenmektedir. Kardiyak rehabilitasyon, hastanın değerlendirilmesi, diyet, kilo verilmesi, egzersiz eğitimi, kronik hastalıkların tedavisi, psikososyal destek, fiziksel aktivite danışmanlığı ve sigaranın bıraktırılması olmak üzere on bileşenden meydana gelmektedir. Kalp ameliyatı geçirmiş yaşlı bireylerde de fiziksel aktivitenin hastanede yatış süresini ve komplikasyon görülme sıklığını azalttığı bildirilmektedir. Bu çalışmanın amacı kalp cerrahisi ameliyatı geçirmiş yaşlı bireylerde erken mobilizasyon ve fonksiyonel egzersizin fiziksel aktivite, fonksiyonel durum ve denge üzerine etkisini değerlendirmektir.

Bu tez çalışması Irak-Bağdat Ibn Al-Bitar Kalp Cerrahisi Hastanesi'nde yapılmıştır. Çalışmaya kardiyak cerrahi geçirmiş 100 hasta (69 erkek, 31 kadın) dahil edilmiştir. Katılımcıların tümü 65 yaş ve üzeri bireylerdir. Katılımcılar, her grupta ellişer hasta olmak üzere Grup A ve Grup B olmak üzere ikiye ayrılmıştır. Grup A müdahale grubu, Grup B kontrol grubu olarak belirlenmiştir. Her iki gruba da konvansiyonel kardiyak fizyoterapi uygulanırken, Grup A'ya ek olarak erken mobilizasyon ve fonksiyonel egzersiz programı (postoperatif ilk 2 gün, yoğun bakım ünitesinde, günde üç kez: glenohumeral ve servikal mobilizasyon, baş kontrolü, el kavrama egzersizleri, oturma pozisyonunda denge egzersizleri, spirometre ile solunum egzersizleri, postüral drenaj, torakal perküzyon ve vibrasyon uygulanmıştır. Postoperatif üçüncü ve yedinci günler arasında ise, günde üç kez: solunum egzersizleri, inspiratuar kas güçlendirme, postüral drenaj, sandalyede oturma kalkma-öne ve geriye yürüme- duvara yaslanıp oturma kalkma gibi fonksiyonel egzersizler, tolerasyona göre 2-10 dakikalık yürüme egzersizleri) uygulanmıştır.

Hastaların demografik ve klinik bilgileri postoperatif ilk gün kaydedilmiştir. Değerlendirme ölçümleri ise postoperatif ilk gün ve yedinci gün yapılmıştır. Değerlendirme ölçeği olarak: Kısa-Form Fiziksel Aktivite anketi (SF-IPAQ) fiziksel aktivitenin değerlendirilmesinde, Zamanlı

Kalk ve Yürü Testi (TUG) dengenin değerlendirilmesinde, İki Dakika Yürüme Testi (2MWT) ve Kısa Fiziksel Performans Ölçeği (SPPB) fonksiyonel kapasitenin ölçülmesinde kullanılmıştır.

Çalışmada elde edilen istatistiksel sonuçlara göre: A grubundaki bireylerin yoğun bakımda kalma sürelerinin B grubuna böre daha az olduğu tespit edilmiş, A grubundaki bireylerin 2MWT sürelerinin B grubuna böre daha fazla olduğu tespit edilmiş, A grubundaki bireylerin SF-IPAQ değerlerinin B grubuna böre daha fazla olduğu tespit edilmiş, A grubundaki bireylerin TUG sürelerinin B grubuna böre daha az olduğu tespit edilmiş ve A grubundaki bireylerin SPPB değerlerinin B grubuna böre daha fazla olduğu tespit edilmiştir. Korelasyon analizine göre A grubundaki bireylerde 2MWT ile SF-IPAQ, TUG ve SPPB arasında pozitif korelasyon TUG ile 2MWT ve SF-IPAQ arasında ise negatif korelasyon tepit edilmiş, diğer parametrelerde ise pozitif korelasyon tespit edilmiştir. B grubunda ise 2MWT ile SF-IPAQ ve SPPB arasında pozitif, SPPB ile SF-IPAQ arasında pozitif, TUG ile SPPB arasında ise negatif korelasyon tespit edilmiştir.

Çalışma sonuçlarına göre kalp cerrahisi geçirmiş yaşlı bireylerde erken mobilizasyon ve fonksiyonel egzersiz, fiziksel aktivite ve fonksiyonellik üzerine iyileştirici etki göstermiştir. Ayrıca erken mobilizasyon ve fonksiyonel egzersizin kalp cerrahisi geçiren geriatrik bireylerde dengeyi de geliştirdiği gözlenmiştir. Çalışmamızda postoperatif ilk yedi günlük veriler değerlendirilmiştir. Dolayısıyla bu konu ile ilgili yapılacak daha uzun takip süreli araştırmalar elde edilen çıkarımları güçlendirecektir.

26 Şubat 2024, 97 Sayfa

Anahtar Kelimeler: Kardiyovasküler hastalıklar, kalp cerrahisi, erken mobilizasyon, fonksiyonel egzersiz, denge, fiziksel aktivite, fonksiyonel kapasite.

1. INTRODUCTION

A heart and blood vessels are part of the cardiovascular system (CVS), also known as the circulatory system (1). Medical conditions that affect the heart and blood arteries are known as cardiovascular diseases (CVD). These include coronary heart disease, cerebrovascular diseases, and congenital heart disease (2). Globally, cardiovascular diseases, including strokes and cardiac events, constitute the primary cause of death. 31% of deaths worldwide in 2016 were related to CVD (3). Among the cardiac disorders that can arise are endocarditis, rheumatic heart disease, and issues with the electrical circuits (4).

Atherosclerosis is the primary cause of many cardiovascular diseases, including peripheral artery disease, coronary heart disease, and strokes. Clinical research has demonstrated that impaired metabolism of cholesterol is a primary cause of cardiovascular disease (5). The mainstays of treatment and management for cardiovascular issues are medication therapy, physical activity, moderate to intense exercise, a nutritious diet, and cardiac surgery (6).

As less invasive procedures are used in cardiac surgery, mortality rates have reduced as a result of advances in CVD therapy (7). However, there are even other variables that raise the risk of complications after cardiac surgery (8). Regular physical activity is a crucial health habit that significantly improves the health and quality of life for those who suffer from heart disease (4). However, because physiotherapeutic therapy helps to avoid difficulties after surgery, its importance has grown. It is commonly known that enrolling patients in a cardiac rehabilitation (CR) program after surgery has several advantages (9).

Physical activity has positive effects on patients undergoing cardiac surgeries. However, if they are incapable of moving extensively or don't exercise enough, their recovery process could be delayed (10). It is commonly known that physical activity lowers a person's risk of coronary lesion (11). Using rehabilitation exercises in the first two to five days following a serious injury or surgical procedure is known as "early mobilization" (12).

When compared to other alternative therapies, early mobilization following a cardiac operation improves physical function more than other treatments (13). However, recent studies suggest that early patient mobility can facilitate oxygen transport and functional recovery, as well as lower post-operative problems and decrease hospital stays (14). A lower number of hospitalizations and problems are seen by older adults who participate in physical exercise during the recovery phase following heart operations (15). Consequently, after cardiac surgery, it's critical to create efficient alternatives to bed rest. One strategy that has gained interest is mobilizing as quickly as possible to mitigate the harmful consequences of inactivity (12).

Thus, a decrease or impairment of one's physical abilities after cardiac surgery (16). Early mobilization is a critical component of the early recovery after surgery (ERAS) protocol. This is because it is essential for a more rapid recovery (13). Conversely, elderly patients are less inclined to start a fitness program because they fear it would exacerbate their discomfort and damage their just healed wound. This is especially true shortly after surgery.

In addition, they report experiencing fatigue early and frequently and exhibiting apprehension, somatization, or animosity (14). As of right now, no systematic reviews have been published that explicitly look into the benefits of functional exercise and early mobilization following cardiac surgery. By examining the effects of early mobilization and functional exercise on the physical activity, balance, and functional status of older individuals following cardiac surgery, this study sought to fill that knowledge gap.

The purpose of this study is to assess the impact of early mobilization and functional exercise on older patients' post-cardiac surgery physical activity, functional status, and balance. The purpose of the study is to take a look at the following theories.

1-H1: Immediate mobilization has a negative impact on older patients' ability to improve their physical activity after cardiac surgery.

1-H0: Improving physical activity after cardiac surgery for elderly people is not negatively impacted by early mobilization.

2- H1: After a cardiac procedure, there is a connection between functional exercise and balance for older people.

2. H0: For older individuals who have had cardiac surgery, there is no connection between functional exercise and balance.
3. H1: For older patients who have had heart surgery, there is a connection between early mobilization and functional status.
3. H0: After cardiac surgery, there is no relationship between geriatric patients' functional state and early mobilization.
4-H1: There is a relationship between functional exercise and physical activity in older people who have had heart surgery.
4-H0: For older patients after heart surgery, there is no relationship between functional exercise and physical activity levels.

2. GENERAL INFORMATION

2.1. Anatomy and Physiology of Heart

The human body's contractile heart muscle takes in deoxygenated blood from every area, pumps it to the respiratory system for oxygenation, and exhales carbon dioxide to remove it. The blood is then transported from the lungs and distributed to every part of the human body (15). The heart is situated in the middle of the thoracic cavity, somewhat to the left (16). The right and left sides of the heart are anatomically divided by the septa, while the atrium and ventricle represent the superior and inferior compartments of the heart, respectively. As seen in (Figure 2.1), the heart is made up of four cavities: the right ventricle, left ventricle, right atrium, and left atrium (17).

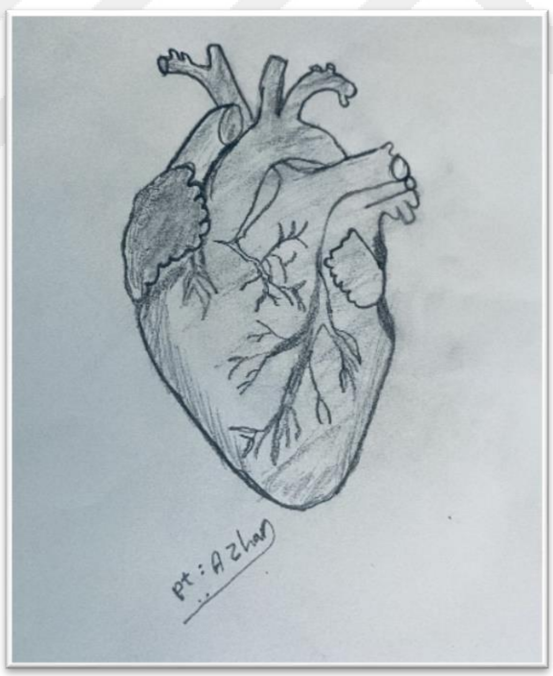


Figure 2.1: Heart anatomy.

The four cavities in the cardiae allow the blood to pass through via quadrupled valves. After passing through the tricuspid valve and the upper and lower veins cava, blood enters the right ventricular and pulmonary valves before reaching the right atrium. It is then released into the pulmonary circulation. Four pulmonary veins supply blood to the heart, a conical hollow muscular tissue housed within the pericardium and situated in the middle mediastinum. The left atrium and left ventricle then receive this blood. The heart pumps blood to various parts of the body to fulfill their nutritional requirements (18).

Blood enters the circulatory system through the aortic valve, left ventricle, and left atrium after passing through four pulmonary veins (19). There are four valves in the heart. Each of the four heart valves serves two functions when it is in good functioning order: it allows blood to flow forward while blocking any backward flow (20).

The heart's natural rhythmicity is modulated by the autonomic nervous system, which causes the heart rate to either accelerate (as in a sympathetic reaction) or decelerate (as in a parasympathetic response). The electrical conduction system of the heart is organized hierarchically, beginning with the sinus node and moving on to the atrioventricular nodes, Purkinje fiber-based His bundle, and ultimately the ventricles.

In order to fully appreciate the therapeutic applications of cardiac electrical activity, one must be aware of its anatomical composition and physiological importance. After heart surgery, atrial fibrillation is significantly more common. By utilizing its anatomical expertise, the Maze method efficiently resolves atrial fibrillation by disrupting abnormal atrial activity. Because prosthetic heart valves are so close to the valve area, they can cause atrioventricular occlusion. The quality of the vascular grafts used in coronary artery bypass graft, or CABG, surgeries determines how well they work. Harvesting vessels is a surgical technique that is used often. When compared to veins, arteries have much greater long-term durability (21).

2.2. Cardiovascular Diseases

The heart and blood vessels are components of the circulatory system, often known as the cardiovascular system (1). Heart disease, stroke, congenital heart diseases, and other conditions affecting the heart and blood vessels are all considered cardiovascular disorders. Cardiovascular illnesses are the main cause of death worldwide (2). Smoking, excessive alcohol use, leading a sedentary lifestyle, and inadequate exercise are behavioral risk factors for cardiovascular disease (2). Diabetes, hypertension, hyperlipidemia, socioeconomic difficulties, physical and psychological stress, and a hereditary tendency to the illness are additional risk factors (2).

Engaging in a total of one hundred fifty minutes of moderately physical movement every week significantly reduces the risk of ischemic cardiovascular disease and diabetes type 2 in adults by nearly one-3rd (22). Physical activity is contributing to reduce body mass, control of glucose levels and arterial pressure, improvement of lipid levels, and enhancement of glucose tolerance.

The benefits of physical activity on the cardiovascular system may be partially explained by these effects (23). Specialized medical care needs to be given to people who are more likely to acquire cardiovascular disease (2). Heart disease is one of the most serious global health issues. The rising frequency of heart problems in older individuals and the resulting disability they cause have serious societal effects, even with the advances in scientific research and cardiac operations (24). Other research, in contrast to predictions, shows that patients' quality of life did not significantly increase following surgery (25).

2.3. Etiology of Cardiovascular Diseases

A number of difficulties can arise from the cardiac system, including transmission system problems, rheumatic heart disease, and endocarditis (26). It is important to treat the risk factors that contribute to atherosclerosis even though there are many variables that can directly cause CVD, such as embolism in individuals with atrial fibrillation that results in ischemic stroke or rheumatic fever that results in valvular heart disease. This is due to the fact that atherosclerosis is a common factor in the development of CVD. Atherosclerosis and other metabolic conditions, such as metabolic syndrome, diabetes mellitus, and hypertension, are common in people with cardiovascular disease (CVD) and are strongly linked to certain lifestyle factors, such as excessive calorie intake, sedentary behavior, and consumption of foods high in saturated fats, added carbohydrates, and sugar (27).

Nine modifiable risk factors were found to account for 90% of the variation in the risk of experiencing a first myocardial infarction (MI) among the participants in the inter-heart studies, which included people from 52 different countries with varying socioeconomic backgrounds. These risk factors included chronic alcohol use, high blood pressure, high cholesterol, belly fat, psychological and social variables, and smoking abuse. It is important to emphasize that this study, across all demographic groups, discovered a direct correlation between smoking and 36% of the risk of MI (28). Additional large-scale cohort analyses have demonstrated a strong association and predictive importance between smoking, glucose intolerance, hypertension, and dyslipidemia.

Between 60 and 90 percent of cases of coronary heart disease were in those who had at least one factor that poses a danger to the general public. The American Heart Association has incorporated these findings into the context of health promotion initiatives, highlighting seven recommendations to reduce the risk of cardiovascular disease. They include giving up smoking, exercising frequently, eating a healthy diet, and controlling hypertension, a high body mass index, blood sugar, and high cholesterol levels to the best of their abilities (29, 30). However, the effects of immutable characteristics like gender, age, and heredity vary (31). Experiencing cardiovascular disease or death from CVD at younger ages (before 55 in males or 65 in females) in a close family member is a separate risk factor for developing atherosclerosis in the person (32).

2.4. Epidemiology of Cardiovascular Diseases

Global morbidity and mortality from cardiovascular disease are already significantly influenced, and this trend is expected to continue for the next few decades (33). Over the ensuing years, there will be a notable increase in the prevalence of cardiovascular disease (34). Globally, CVD is a major health concern (35). With a three- to five-fold increased risk, South Asians have a much higher prevalence of coronary artery diseases (CAD) than people from other ethnic groups.

Furthermore, there is an 80% increase in the prevalence of CVD among those living in low- and middle-income countries (36, 37). 2015 saw heart disease emerge as the leading cause of death, with cancer accounting for 595,930 of those deaths. Since 1975, cardiovascular disease has been one of the top two causes of death in the US, accounting for 633,842 deaths, or 1 in every 4 deaths (38). According to the Global Health Association, 17.7 million deaths worldwide were attributed to cardiovascular disease in 2015. The additional expenses associated with cardiovascular disease are expected to be $237 billion annually, more than those associated with diabetes and Alzheimer's combined. Moreover, it is projected that by 2035, these costs will reach $368 billion (39).

In 2018, cardiovascular problems resulted in 23048 mortalities in Croatia, making up 43.7% of all fatalities, which is almost half of the total. Coronary heart disease is the predominant kind of cardiovascular illness, marked by the constriction or blockage of the coronary arteries due to atherosclerosis (40) . According to statistics from the World Health Organization (WHO), between 60 and 85 percent of people worldwide live sedentary lifestyles. Both residents of industrialized and developing countries are included in this statistic. According to estimates from the World Health Organization, physical inactivity directly causes about 3.2 million deaths worldwide each year (41).

2.5. Pathophysiology of Cardiovascular Diseases

Atherosclerosis is a disease that affects the arteries and aorta as a result of blood vessel narrowing, which reduces or blocks blood flow (44). Numerous factors, including as dyslipidemia, immunological processes, inflammatory response, and impaired endothelial function, might affect the syndrome. These elements are thought to be the catalyst for the development of oily lines. which ones are important in terms of the panel formation that results in atherosclerosis (45). The components of the atheroma plaque include smooth muscle cell layers that adhere to one another and divide, extra tissue and lipids, and macrophages rich in lipids (46). These tumors have the potential to induce apoptosis in deeper levels as they enlarge. This may attract additional macrophages, which through atherosclerosis, may produce atherosclerotic plaques (47).

2.6. Cardiovascular Clinic and Physical Examination

These tumors have the potential to trigger apoptosis in deeper levels as they enlarge. This may attract additional macrophages, which through atherosclerosis, may produce atherosclerotic plaques (48). In the past, angina, a form of discomfort behind the sternum with a sharp pressure or crushing sensation, was a prevalent symptom of coronary artery disease patients. The jaw, neck, or left upper limb may all feel affected by this soreness. Furthermore, it could be linked to symptoms including nausea, vomiting, palpitations, excessive perspiration, fainting, or, in the worst situations, unexpected death (49).

Further evidence of an ischemia cause may be found in the experience of an increase in chest pain during physical activity or movement, followed by alleviation after resting or taking nitroglycerin (50). Most people with a thoracic aortic aneurysm don't have any symptoms at first, but as the illness worsens, symptoms could appear. The symptoms could range from sudden, severe thorax or back pain due to a fast rupture to coughing, dyspnea, or difficulty speaking (51). Similar to this, abdominal aortic aneurysms could not show any symptoms until they unexpectedly burst, resulting in excruciating pain in the abdomen or unconsciousness (52,53).

2.7. Evaluation of Cardiovascular Diseases

A detailed evaluation of the patient's medical history and a complete physical examination are required for the diagnosis of CVD, with special attention paid to the circulatory system, though other areas may also be taken into account. For example, if a patient exhibits symptoms that are frequently associated with obesity, such as angina, decreased ability to exercise, difficulty breathing at night, fainting (syncope or pre-syncope), claudication, the healthcare provider should perform a more thorough evaluation of the patient's medical history and physical state. Further diagnostic testing, such as an ECG and cardiac enzymes for patients with significant thoracic pain, should be ordered if necessary, depending on the specific clinical circumstances (54,55).

2.8. Treatment of Cardiovascular Diseases

Depending on the specific medical circumstances, there are several therapy options for cardiovascular disease. Among them are For acute strokes brought on by ischemic stroke, catheter-directed thrombolysis is a therapy option; for peripheral vascular disorders, angioplasty is performed. coronary stenting or surgical procedures for the treatment of coronary heart disease. However, people who already have CVD should be well educated about the need of secondary prevention, which includes changing risk factors and leading a healthy lifestyle (30). Heart surgery, physical exercise, a balanced diet, and medication are the main treatments for cardiovascular diseases (6).

2.8.1. Medical Treatment of Cardiovascular Diseases

Beta-blockers, angiotensin-converting enzyme inhibitors, and aspirin. ACE inhibitors and statins are two examples of medications used to treat cardiovascular conditions (56). The International Association for Pharm economics and Research on Outcomes defines pharmaceutical compliance as the extent to which a patient adheres to the prescribed schedule and dosage of a drug regimen (57). The majority of commonly prescribed medications for cardiovascular disease, including beta blockers, ACE inhibitors, statins, antiplatelets, and angiotensin II antagonists, are well tolerated and rarely cause major side effects (58).

2.8.2. Surgical Procedures for Cardiovascular Diseases

Furthermore, the discipline of cardiology frequently uses procedures like balloon angioplasty, cardiac transplantation, and the placement of transplanted organs in addition to more invasive ones. In order to treat cardiac problems, further procedures and devices such pacemakers, prosthetic valves, and patching could also be required (35). Heart operations are becoming less invasive as a result of the quick development of cardiovascular therapy. This strategy has effectively decreased the cardiovascular disease-related death rate (56).

However, there are still a lot of possible problems after heart surgery (8). On the other hand, heart valve problems might be inherited, appear later in life, or be brought on by an infection. The two main classifications of this condition are regurgitation/insufficiency and stenosis. Severe aortic stenosis is the most prevalent heart valve condition among the older population in the West. A shorter lifespan and a higher chance of death are linked to this syndrome. One could categorize artificial heart valves as biological or mechanical (60).

Extracorporeal circulation (ECC), which is frequently used in many cardiac surgical procedures, can cause a systemic inflammatory reaction. This can result in the release of chemicals that obstruct blood coagulation and the immune system's ability to respond. As such, those who have extended bouts of ECC are more likely to develop severe neurological abnormalities (61). ECC-related neurological damage can have serious repercussions, including decreased autonomy and a general decline in quality of life.

The two main variables associated with the reduction in functional autonomy are the length of ICU stay and the use of mechanical ventilation. These variables make it difficult for patients to complete daily tasks like eating and cleaning themselves after being released from the hospital (62).

2.9. Cardiac Surgery

The medical field of cardiac surgery focuses on diagnosing and surgically treating heart and thoracic aortic disorders. The development of cardiac operations, which began in the late 1800s, demonstrates the full spectrum of modern techniques (63). The diagnosis and surgical treatment of heart and thoracic aortic disorders are the main goals of the specialty of cardiac surgery in medicine. The development of heart surgery, which began in the late 1800s, shows the full range of contemporary techniques (64).

Cardiovascular surgery differentiates aside from other types of treatment because new methods and materials have been used, resulting in increased safety precautions and reduced risks during the perioperative period. Despite these advancements, postoperative complications continue to be common and have an effect on the length of hospital stay as well as the return to normal activities (65). Sternotomy is the procedure used for most heart surgeries, as shown in (Figure 2.2).

Figure 2.2: Cardiac operation room (72).

After heart surgery, the average period of hospital stay is approximately ten days (68). Patients often stay in the ICU at a hospital for around 48 hours following cardiac surgery, during which time nurses closely monitor their vital signs, oxygen saturation, and heart rate. thoracostomy procedures to remove hemopericardium and hemothorax (69). Revascularization is a surgical technique used to treat atherosclerosis-aggravated ischemic heart disease (70,71).

2.9.1. Indications for Cardiac Surgery

Heart surgery and interventional cardiac treatments are classified together in the global system for the classification of diseases and health conditions under the system that uses symbols to name ailments. Individuals with valve cardiac conditions are able to distinguish between stenotic lesions and regurgitation. In place of the four-point scale used for angiographic grading in the catheterization lab, a scale ranging from mild to serious is sometimes employed to assess valve diseases. Valve surgery is necessary for patients with severe stenosis or regurgitation. Physicians can replace or repair a patient's broken valve (73).

The primary cause of mitral stenosis, rheumatic heart disease, is not commonly observed in developed countries. The cause of mitral regurgitation determines the course of treatment (74). Cardiac surgery is a treatment option for many different heart rhythm disorders. Similar to implanted devices, pacemakers can be used to treat severe heart failure through cardiac synchronization, ventricular arrhythmia, and twin chamber devices for atrioventricular blocking.

When talking about congenital cardiac conditions, it's critical to distinguish between cyanotic and non-cyanotic areas. In medicine, it is possible to patch up holes in the heart's chambers or ventricles. Many medical conditions, including transposition of the main vessels, tetralogy of Fallot, and Ebstein abnormality, require specialized operations. Atrial myxoma is the most common benign heart tumor. The most typical type of malignant development in the heart is a sarcoma. There are instances when coronary artery disease is best treated by CABG (75).

2.9.2. Common Types of Cardiac Surgery

-Coronary artery bypass grafting: CABG surgery is a common treatment for coronary ischemia (76). This procedure, also known as "revascularization," aims to redirect blood flow from the coronary artery to another area of the body in order to prevent a solid clot from forming there. This can be accomplished in a variety of ways, and the vessels utilized can originate from various locations (77). Due to its remarkable efficacy in treating patients with left main coronary artery disease and multiple vessels, coronary artery bypass grafting remains one of the most common major surgeries. Even though the average patient is now at a higher risk, over time, there has been a significant decrease in both surgical deaths and other issues. The five-year and ten-year survival rates are 85% and 95%, respectively (78).

Those who have tried medication and percutaneous coronary intervention (PCI) but neither of them has proved effective may choose CABG surgery. Previous studies have demonstrated that, in comparison to PCI, CABG treatment is associated with decreased rates and risks of myocardial infarction, coronary coronary mortality, and repeat revascularizations (79). Alert signs in most cases, CABG is advised when PCI has failed to remove high-grade blockages on both of the primary coronary arteries (80).

-Surgery for valve diseases: Artificial or bioprosthetic valves can be used to replace a natural valve that has been damaged or becomes ill. If these valves are appropriately tested, submitted to, and then given anticoagulant treatment, they both show a longer lifespan when compared to natural valves. medicine throughout the duration of the patient's life (81).

For individuals with symptoms or significant constriction or leaking of the aortic valve, aortic valve replacement or repair (AVR) is an option. After CABG or other heart valve surgery, it is also a possibility for those with mild aortic valve constriction or leakage. Patients with mild to severe mitral regurgitation or stenosis have their mitral valves replaced or repaired. As an alternative, those undergoing other cardiac procedures or those with less severe tricuspid malfunction may have their tricuspid valve repaired or replaced (82).

-Congenital heart defects surgery: Congenital heart disorders are conditions affecting the heart that arise in infancy. They might alter the natural blood pumping function of the heart. The most common birth abnormality is heart disease, which is present from birth (83). Congenital heart disease has been successfully treated with both medical and surgical approaches. However, many treatments focus more on comfort than recovery, and some survivors continue to have long-term problems with their electrical conductivity and blood flow (84).

2.9.3. Complications after Cardiac Surgery

Congenital heart disease has responded well to both medicinal and surgical therapies. The majority of post-heart surgery complications are brought on by diseases and risk factors linked to the procedure. Of particular interest are age, gender, length of cardiopulmonary bypass, diabetes, obesity, and history of renal or cardiovascular disease. and an unexpected heart attack (85).

Congenital cardiovascular disease has been successfully treated surgically and medically, yet many patients experience difficulties with their hearts, lungs, and nerves following heart surgery. Following a sudden myocardial infarction or congestive heart failure, cardiac issues are more prone to occur. On the other hand, a stroke could happen in the brain the day after surgery. Lung tissue is the source of sickness for those suffering from atelectasis, respiratory infections, severe breathing difficulties, acute respiratory distress syndrome, or pleural fluid (66).

Congenital heart disease has been successfully treated with both medication and surgery. Bleeding after surgery is also a major problem (62), and renal failure can occasionally result from problems with kidney function (86). A type 5 myocardial infarction, according to the worldwide classification, occurs after a cardiac procedure. Five to ten percent of occurrences are typical (89). Individuals who have had surgery frequently have edema, fevers, and elevated inflammatory marker levels. Thus, distinguishing between individuals who are infected and those who are really ill may be challenging (90). New details may become evident over time. If symptoms appear on day two or day three after surgery, they should be investigated (91).

2.9.4. Clinical Significance of Cardiac Surgery

Following cardiac surgery, the prognosis, symptoms, likelihood of ischemic consequences, and functional level can all improve (82). Following cardiac surgery, many report an improvement in their quality of life. If a patient's disease symptoms can be reduced and their functional abilities can be enhanced, their quality of life will increase. Even so, complications from more involved surgical operations may necessitate longer stays in the intensive care unit and bed rest; cardiac bypasses are frequently utilized in combination with one another. (8).

Cardiothoracic surgery is a crucial component in maintaining the health of your circulatory and cardiac systems. The number of people worldwide who suffer from cardiovascular diseases has been progressively increasing due to a bigger change in epidemiology, which includes atherosclerosis, high blood pressure, and other risk factors. About 1% to 2% of the US healthcare budget, or $20 billion, is spent on heart surgery. For this type of treatment, the average cost of hospital stays is $40,000 (92).

2.10. Physical Therapeutic Procedures

2.10.1. Physical Activity

Exercise It is defined as "body movement that is caused by the contraction of skeletal muscles and that increases energy consumption." (93). Any movement of your body that is powered by your skeletal muscles is considered physical activity (94). Regular physical activity is a basic health habit that has a substantial impact on the mental and physical well-being of an individual with heart disease (4).

Regular participation in mild to moderate exercise reduces the risk of suffering from secondary cardiac events and shortens hospital stays (95), relieves pain (96), lessens symptoms of depression (97), eases tension or anxiety (98), and enhances a healthy lifestyle (99). Beginning exercising after cardiac surgery helps patients improve, but not exercising adequately can make recovery more difficult (10).

In contrast to the individuals who did not take a component, individuals who had cardiac surgery and underwent cardiac rehabilitation (CR), or physiotherapist-supervised exercise, reported being able to do more, consuming shorter periods in the hospital after surgery, experiencing fewer postoperative complications (13), and experiencing fewer readmissions (101). People who were physically active after surgery had a lower incidence of cardiovascular problems over a longer length of time (101).

As reported by Itagaki et al., 17% of patients had decreased physical ability following cardiac surgery. There are several medical reasons that could have anticipated the decline, some of which are modifiable. These results suggest that more interventional research might be conducted to help restore the loss of physical functionality in older adults undergoing cardiac surgery, both before and after the surgery (105).

Nonetheless, the findings indicate that physical activity reduces the risk of cardiovascular disorders in individuals from middle age to early old age (111). Numerous research have examined the relationship between variations in physical activity levels and certain heart health outcomes, particularly with regard to age and sex disparities amongst those over 65 (113). Research indicates that regular physical exercise and managing risk factors for cardiovascular illnesses reduce the number of problems following surgery and hospital readmissions, as well as the mortality rate for individuals with cardiac diseases (101).

In order to reduce risks, exercise is crucial for patients recovering from cardiac surgery; yet, many post-operative patients do not engage in enough physical activity (114). According to research by Van Laar et al. (10), 40% of patients who had cardiac surgery weren't exercising after the procedure. Moreover, Brocks et al. observed that after receiving a heart transplant, more over half of the women in her research did not engage in any physical activity. Moreover, research that examined individuals who underwent heart surgery and then participated in CR (116).

2.10.2. Early Mobilization

Early mobilization is the technique of participating in physical activity within the first two to five days following a severe illness or disease, such as walking and passive range of motion exercises (12). Participating in physical exercise during the recovery period after heart surgery has been linked to shorter hospital stays and a lower rate of complications following heart surgery (129). Therefore, it is critical to develop effective techniques to reduce the adverse consequences of bed rest after heart surgery. Interest has grown in early mobilization as a means of reducing the harmful consequences of extended bed rest (12). When a patient presents with appropriate clinical characteristics for the intervention, early mobilization in cardiac surgery is started in the first few hours after the surgery (130).

2.10.3. Functional Exercises

The purpose of exercise is to improve or maintain one or more aspects of physical fitness through the intentional and methodical performance of repetitive physical motions. In conclusion, exercise improves vascular health by lowering arterial stiffness and hypertension (117). Patients following open-heart surgery are often administered respiratory therapy and breathing exercises, either with or without a machine to avoid or prevent the emergence of a deterioration in pulmonary function. The interventions include deep breathing exercises (68), breathing muscle exercises (120), cough stimulation assistance (121), early mobilization and placement (118), spirometry as an incentive (IS), positive lung pressure during expiration (119), and a dynamic sequence of active cycle of breathing techniques (120).

Engaging in before -operation It has been known for a while that strengthening the breathing muscles prior to surgery reduces the risk of anesthesia-related complications. It also reduces the length of time patients stay in the hospital following surgery, lessens post-operative problems, and enhances the ability of the respiratory system to function (123).

Physical activity shortens hospital stays, even those in intensive care units (124). Exercise-based cardiac rehabilitation (CR) is commonly recommended for people who have had valve replacement surgery (125). Exercise is essential for hastening the healing process following surgery. Cardiovascular rehabilitation has frequently made use of a variety of techniques and tools (126). During the early stages of rehabilitation activities, patients who undergo heart surgery have poorer exercise capacity than those who undergo less invasive or non-cardiac operations (127). The severity of the illness and the high rate of comorbidities (128), the length of the muscle deconditioning phase (129), pain at the site of a surgical incision (130), and the thoracic drainage and extracorporeal circulation (131) are all associated with these changes.

As a result, it is frequently observed that functional ability decreases when a patient is in the intensive care unit (97). Scientifically speaking, this claim is mainly backed by the well-established positive effects of exercise training on cardiac conditions in general, with an emphasis on those who have coronary heart disease in particular (125). A recent study that involved a sizable number of people in the US revealed that taking part in cardiac rehabilitation was associated with a reduction in hospital admissions and the death rate within the first year following CR completion (132). However, there are no widely accepted and evaluated standards for the nature, scope, mode, length, and level of exercise-focused cardiac rehabilitation after valve replacement or repair (125).

2.10.4. Functional Capacity

The initial essential phase to evaluating the risk of cardiac problems prior to surgery has been measuring functional capacity (133). There have been concerns raised about the validity of employing interviews to assess functional capability (134). A decrease in functional ability has been shown in multiple studies to occur during the preoperative and postoperative phases of heart surgery (131). In spite of this, patients who did not take part in any research procedure showed spontaneous restoration of functional capacity (135). In other situations, such as those involving geriatric people, it may be sufficient to decrease physical activity levels and lengthen the recovery period (136). To determine customized therapies that take into account particular characteristics like technique, strength, frequency, and period, personalized assessments are crucial (137).

For geriatric patients the most suitable test used to evaluate functional capability is the 2MWT (139). However, there was a recorded instance of spontaneous functional ability recovery, even in those without participation in any particular study program (135). It may be sufficient in some situations, such as with elderly patients, to decrease training volume and lengthen recovery sessions (136). Personalized assessments are essential for recommending an organized treatment plan that considers particular attributes including modality, intensity, frequency, and duration (137). and thus, the long-term functional outcomes after hospitalization (138).

2.10.5. Balance

Managing the position of the center of gravity, or the focal point of weight distribution, is referred to as balance. To keep control over the body's center of gravity, the Central Nervous System (CNS) controls postural control throughout both stationary and locomotor movements (148). Static balance and dynamic balance are the two subcategories under balance. The initial one concerns the maintenance of the individual's immobile posture. Dynamic balance, another name for postural performance, is the ability to actively control one's body's alignment to promote effective mobility and avoid falling in a variety of conditions, both at rest and when moving (149).

All voluntary motor abilities are based on balance, which is also necessary for performing daily tasks (150). The center of gravity's position, the work required, the stability limit, and the supporting surface all have an impact on the equilibrium. The forces exerted on the body in this position are minimal because the center of gravity is situated anterior to the second sacral vertebra. The part of the body that experiences the combined force of gravity and body weight is referred to as the support surface. When sitting, the main supporting structure is the thighs and hips, and when standing, the main supporting structure is the feet (151).

Stability depends mostly on the integration of data from the vestibular, somatosensory, and visual systems (152). The three main sensory systems are in charge of coordinating movement, observing variations in both linear and rotational acceleration, and recognizing the direction of gravity in addition to the position, velocity, and contact of body parts with outside objects (153). Strength and balance are the two essential components of physical fitness. In order to safely perform activities of daily life, postural balance—a complex motor skill that involves adjusting one's body position to prevent falls—is essential (154).

People with cardiovascular disease may experience impaired lower limb function and problems with balance. Postural instability may result from this, which could negatively impact patients' care and general quality of life (155). Deficits in balance are also associated with a higher chance of falling, a higher chance of being sick and dying, and higher healthcare costs (156).

3. METHOD

3.1 Patients and Study Design

This research evaluated the outcomes of functional exercises and early mobilization in older individuals who have had cardiac surgery through a single-blind controlled study. The purpose of the study was to assess how these therapies affected the patients' stability, functional status, and level of physical activity.

This study was accepted to be medically appropriate by the Clinical Research Ethics Committee of the Health Ministry of Iraq (Decision Number: 903 in 2023/14/12), (Appendix 1). The study was conducted at the Ibn Al-Bitar Specialties Center for Cardiac Surgery in Baghdad, Iraq and data were collected between December 2023 and January 2024.

A total of 100 geriatric patients—69 men and 31 women—who had undergone heart surgery and were up to 65 years old—voluntarily took part in the study. There were fifty patients in each of the two groups that the participants were divided into: the early mobilization group (Group A) and the control group (Group B). The patients in early mobilization group underwent early mobilization and functional exercises program, while the patients served as the control group did not receive the therapy protocol applied in the early mobilization group (Table 3.1.).

3.1.1. Inclusion Criteria

Individuals who had previously had valve replacement procedures or coronary artery bypass grafting (CABG) and if all of these procedures were done by sternotomy were included in the study. The study's patients were all classified as geriatric, with ages ranging from 65 to 75. There were people of both genders in the sample. Throughout their recovery, patients who were awake, conscious, and able to communicate vocally as well as those who were able to understand and complete scales and questionnaires. Patients who signed consent forms voluntarily agreed to participate, as well as those who successfully passed the two-minute walk test (2MWT), which assesses how long it takes to walk for two minutes.

3.1.2. Exclusion Criteria

Patients unable to complete the two-minute walk test (2MWT), scales, or questionnaires. Individuals who suffered from stroke, extensive bleeding, renal failure or insufficiency, atrial fibrillation, the necessity for a second operation, or a serious infection of the sternal wound following surgery. Those who struggle with vocal and auditory communication. individuals who underwent surgery and had a pacemaker inserted. those who have experienced a prior cerebrovascular accident. Those who have suffered from neurological disorders like hemiplegia after heart surgery and mental health problems like intellectual incapacity.

3.2. Treatment Procedure

Table 3.1: Therapy program for group A and B.

Group A	On the 1st and 2nd post-operative days	In the ICU: shoulder & neck mobilization, head control, good hand grasp, balance in sitting position with breathing exercises by spirometry & postural drainage by cupping (8 times per day).
	On the 3rd and 7th post-operative days	Breathing exercises, inspiratory muscle strength, postural drainage, functional exercise (stand up and sitting down on the chair, walking inward, back-ward ,and sideways), weight shifts from left to right, step up inside the patch , one leg stand, squatting leaning against wall) for three times per the day and repetition fifteen times (3 times per day for 15 repetition) and supervised walking with increments of 2 minutes, as tolerated up to 6 minutes or more at the morning, afternoon, evening and at night.
Group B	On the 1st and 2nd post-operative days	In the ICU: breathing exercises by spirometry & postural drainage by cupping (4 times per day).
	On the 3rd and 7th post-operative days	Breathing exercises, inspiratory muscle strength, postural drainage, walking as tolerated up to 5 minutes at the morning and the evening.

• Starting from the first and second day after surgery, the patient underwent shoulder and neck mobilization as showed in Figure 3.1.

Figure 3.1: Head and shoulder mobilization.

• Demonstrated a hand grasp, maintained balance while sitting as showed in Figure 3.2.

Figure 3.2: Balance control with sitting position and hand grasp.

• Performed breathing exercises by using spirometry as showed in Figure 3.3.

Figure 3.3: Improve respiratory muscle by spirometry.

• Additionally, postural drainage was administered using cupping hand, with a frequency at least must be three times per day as showed in Figure 3.4.

Figure 3.4: Coughing training for remove secretion.

3.3. Demographic and Clinical Information Collection

Data was collected for all patients' height, weight, body mass index (BMI), gender, age, social situation, and usage of alcohol and cigarettes on the seventh day following surgery. Behavioral habits, past medical history of chronic conditions (e.g., high blood pressure, hyperthyroidism, bronchial allergies, high cholesterol), length of stay in the intensive care unit, type of heart surgery, and prior procedures are all taken into consideration (Appendix 2).

3.4. Outcome Measurements

On the seventh day following cardiac surgery, the following tests, scales, and questionnaires were given to all study participants. To assess levels of physical activity, the Short-Form International Physical Activity Questionnaire (SF-IPAQ) is utilized. The two-minute walking test (2MWT) is employed to assess an individual's status of functioning. The Timed Up and Go Test (TUG) is used to assess the degree of balance and the probability of falls. One well-known tool for assessing physical performance and identifying fragile people is the short physical performance battery (SPPB) exam.

3.4.1. International Physical Activity Questionnaire

The Short Form of the International Physical Activity Questionnaire (SF-IPAQ) was used to measure physical activity (PA). Participants were asked to describe how many days they had spent performing vigorous, moderate, and walking activities over the course of the previous week, as well as the duration of those activities (157). They were applied to each activity in order to assign an approximate MET (metabolic equivalent of task) value (158). Based on their SF-IPAQ scores, participants were classified as having high, moderate, or low levels of physical activity basics (159). People were classified as inactive if they did not meet the criteria for low levels of physical activity, which were determined by the length and frequency of vigorous, moderate, or walking activities. On the other hand, people who met the requirements for classifications as high or moderate in physical activity were regarded as active (160,161). The score calculated according global questionnaire (Appendix 3).

3.4.2. Two Minute Walking Test

The 2MWT was performed over a 50-ft (15.2-m) out-and-back course. Participants were instructed to walk as fast as they could until asked to stop. They were also told not to worry if they had to slow down or rest, but that if they stopped they should start walking again as soon as they felt ready to do so. When 1 minute had elapsed, they were told “You are doing well; you have 1 minute left.” Participants stopped walking at 2 minutes, and the distance covered was documented (140, 161-166), (Figure 3.5), (Appendix 4).

Figure 3.5: Two minute walk test (167).

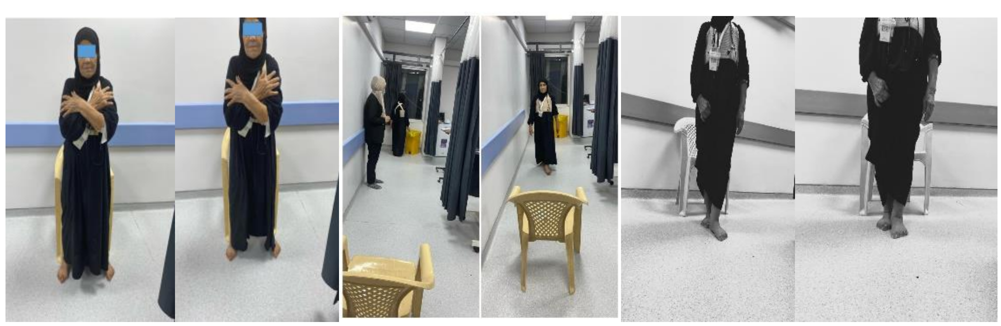
3.4.3. Time Up and Go Test

The Time Up and Go Test is used to assess the degree of balance and fall risk. The test begins with the subject seated. Next, they have to get a standing position and walk three meters. Finally, they must return to the chair and sit again. The patient gets up from the chair, sits down, and begins the test by standing up, moving three meters, going back to the chair, and sitting down again. The purpose of this test is to evaluate the level of mobility (Figure 3.6.), (168-170), (Appendix 5).

Figure 3.6: Time up and Go test (170)**.**

3.4.4. Short Physical Performance Battery

The Short Physical Performance Battery (SPPB) consists of three tests: (i) static standing balance, where participants are required to maintain three different positions (side-by-side, semi-tandem, and tandem) for 10 seconds each; (ii) gait speed, which involves walking a distance of 4 meters and recording the best time out of two trials; and (iii) chair rise, where participants must stand up and sit down five times consecutively as quickly as possible. The scoring of each individual test ranges from 0 to 4 points, with higher scores indicating better performance. The three test scores are then summed to calculate an overall SPPB performance score, which can range from 0 to 12 points. This score is then separated into four groups (G1-G4) based on certain cut-points (Figure 3.7.), (171-175), (Appendix 6).



A B C D E F

Figure (3.7.A-F): SPPB assessment.

3.5. Sample Size

The sample size was determined using the G* Power 3.1.7.9 software tool developed by Heinrich-Heine-Universitas in Düsseldorf, Germany. The sample size calculation was conducted to determine the minimum number of participants needed to detect a medium effect size of 0.3 for the difference in the primary outcome between the two groups. A minimum of 41 patients is required per group in order to detect this difference with a significance level (α) of 0.05 and a study power of 80%. In order to account for potential attrition of up to 17%, we made the decision to enroll 50 patients each group. The determination of the sample size was determined by considering the 2-sided difference between two groups using an independent samples test.

3.6. Statistical Analysis

The statistical data is displayed as numerical values and percentages for the categorical variables, and it is examined through the utilization of the Chi-square test. The mean and standard deviation (SD) were used to show quantitative parametric data, which were examined using an independent samples student t-test. The median and interquartile range were used to present quantitative non-parametric variables, which were evaluated using the Independent-Samples Mann-Whitney U Test. The SF-IPAQ served as a valuable instrument for evaluating physical activity in the elderly population, whereas the 2MWT is a straightforward and useful test employed to quantify an individual's functional capability and ability to tolerate exercise. The paired samples test was utilized to examine the existence of disparity in the vital signs prior to and subsequent to the 2MWT. Pearson's and Spearman's correlation coefficients were employed to assess the relationship between various variables. The study was conducted using IBM SPSS 28 program for windows. A P-value less than 0.05 is deemed to be statistically significant.

4. RESULTS

The sample size for the study was 100 people, whose average age was 67.08 years. Sixty-nine percent of the participants were male, and seventy-six percent had completed elementary school. 170.49 centimeters was the average length, 79.70 kg was the average weight, and 27.78 (kg/m2) was the average BMI. The study comprised 100 individuals whose clinical histories revealed a noteworthy preponderance of specific conditions: hypertension (75.0%), diabetes (35.0%), smoking (61.0%), and hyperlipidemia (91.0%). Ninety percent of the individuals underwent sternotomy surgery, and 62.0% of them reported having other problems. Of the 17.0% of patients who had had prior surgery, the distribution was as follows: 41.2% had had cesarean sections, 23.5% had had joint replacements, and a range of other procedures. Along 93.0% of the patients receiving it, CABG was the most frequently performed surgery (Table 4.1).

Table 4.1: Characteristics of the patients.

	Mean	**SD**
Age	67.08	2.87
Length	170.49	7.13
Weight	79.70	11.26
BMI (Kg/m^2)	27.78	3.33
	N	**%**
Sex		
Male	69	69
Female	31	31
Marital Status		
Married	100	100.00
Educational level		
Primary	76	76.0
Secondary	9	9.0
College	15	15.0

The patients ranged in age from 65 to 80 years old, with a mean age of 67.08 years (SD = 2.87). The patients' mean weight was 79.70 kg (SD = 11.26) and their mean length was 170.49 cm (SD = 7.13). The patients' average Body Mass Index (BMI) was 27.78 (Kg/m^2) (SD = 3.33), (Table 4.2).

Table 4.2: Comparison of patients' characteristics across the two groups.

		Group (A) with early mobilization and functional exercise (N=50)	Group (B) without early mobilization and functional exercise (N=50)	P-value
		Mean ± SD	**Mean ± SD**	
Age		66.92 ± 2.86	67.24 ± 2.91	0.580
Length		169.52 ± 7.50	171.46 ± 6.67	0.175
Weight		75.32 ± 11.35	84.08 ± 9.39	**<0.001***
BMI		26.51 ± 3.32	29.04 ± 2.85	**<0.001***
		N (%)	**N (%)**	**P-value**
Gender	Male	31 (62%)	38 (76%)	0.13
	Female	19 (38%)	12 (24 %)	
Educational level	Primary	35 (70%)	41 (82%)	0.229
	Secondary	7 (14%)	2 (4%)	
	College	8 (16%)	7 (14%)	

*: significant as P value ≤ 0.05, Number ; N

Regarding weight and BMI, there was a statistically significant difference between the early mobilization groups. The patients in group B had a mean weight of 84.08 kg with a standard deviation of 9.39, which was higher than the mean weight of 75.32 kg in group A (P<0.001). The patients in group B had a mean BMI of 29.04 kg/m2 with (SD= 2.85), P<0.001, higher than the mean BMI of group A, which was 26.51 kg/m2 with (SD= 3.32).

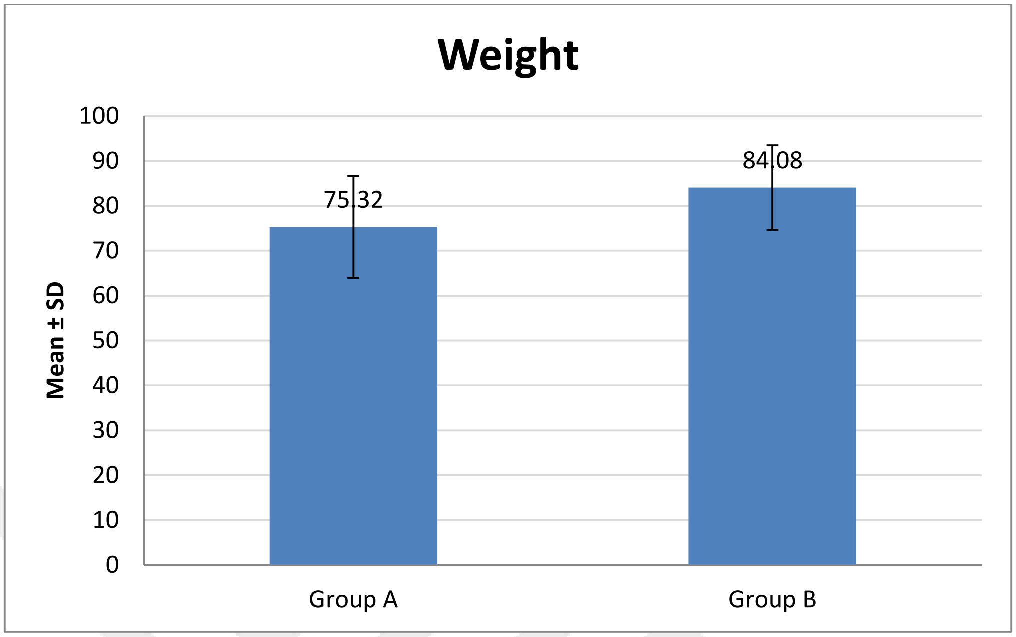


Figure 4.4: Mean weight of patients in group A and group B.

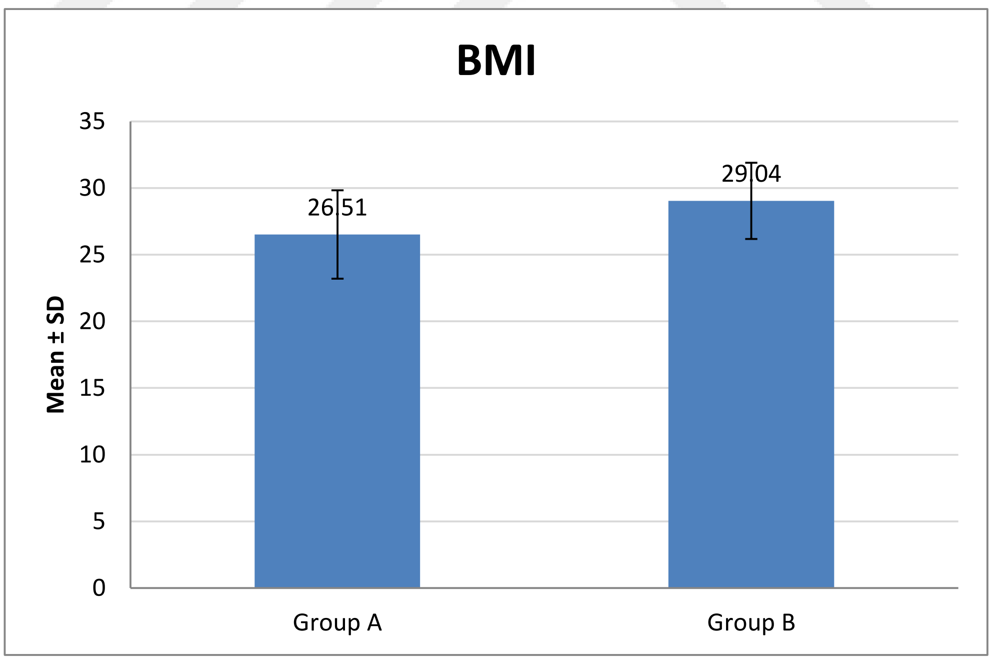


Figure 4.5: Mean BMI of patients in group A and group B.

Table 4.3: Comparison of patients' clinical history across the two groups.

		Group (A) with mobilization and functional ex (N=50)	Group (B) without early mobilization and functional ex (N=50)	P-value
Smoker		28 (56%)	33 (66%)	0.305
Drinking		3 (6%)	6 (12%)	0.487
Hypertension		37 (74%)	38 (76%)	0.817
Diabetic		17 (34%)	18 (36%)	0.834
Hyperlipidemia		46 (92%)	45 (90%)	>0.999
Other diseases		32 (64%)	30 (60%)	0.680
Is surgery by sternotomy	No	5 (10%)	5 (10%)	>0.999
	Yes	45 (90%)	45 (90%)	
Was there old surgery	No	42 (84%)	41 (82%)	0.945
	Cesarean operation	4 (8%)	3 (6%)	
	Joint surgery	1 (2%)	3 (6%)	
	Hernia operation	1 (2%)	1 (2%)	
	Eye operation	1 (2%)	1 (2%)	
	Appendicitis	1 (2%)	0 (0%)	
	Thyroidectomy	0 (0%)	1 (2%)	
Stay period in ICU (in days)	2 days	39 (78%)	41 (82%)	0.617
	3 days	11 (22%)	9 (18%)	

Table 4.3 shows the comparison of patients' clinical history across groups. There was no statistically significant difference between the two groups regarding patients' clinical history.

Table 4.4: Comparison of 2MWT across early mobilization and functional exercise.

	Group (A) with early mobilization and functional ex (N=50)	Group (B) without early mobilization and functional ex (N=50)	P-value
Distance Walked in 2 minutes	135.6 ± 9.29	123.4 ± 8.48	**<0.001***
Vital signs			
SPO2 before	95.92 ± 1.41	92.94 ± 11.63	0.078
SPO2 After	98.34 ± 0.89	98.22 ± 1.3	0.592
PR before	83.26 ± 5.17	82.68 ± 3.89	0.527
PR After	93.96 ± 5.19	93.5 ± 5.33	0.663
Systolic BP before	126.74 ± 6.51	126.3 ± 6.31	0.732
Diastolic BP before	84.6 ± 5.42	84.4 ± 5.01	0.849
Systolic BP After	130.48 ± 7.3	130.16 ± 8.97	0.845
Diastolic BP After	85.6 ± 5.12	85.72 ± 5.57	0.911

*: significant as P value ≤ 0.05, Pulse Rate: PR, Saturation pulse oxygen level: SPO2, Blood pressure: BP.

Regarding the distance walked in two minutes, there was a statistically significant difference between the early mobilization groups. The mean walking distance in two minutes revealed a statistically significant difference: the mean walking distance in group (A) was higher at 135.6 ± 9.29 than the mean walking distance in group (B) was lower at 123.4 ± 8.48, P<0.001, (Table 4.4).

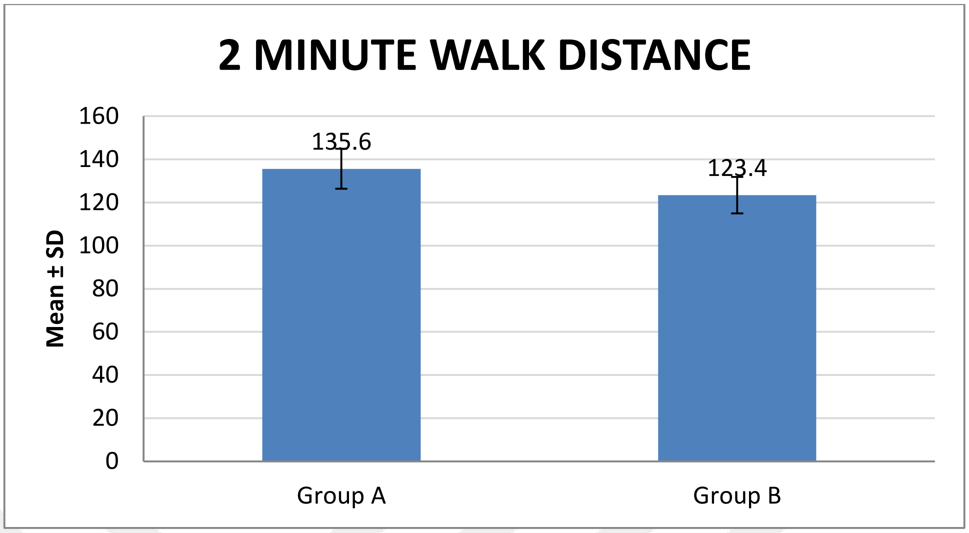


Figure 4.3: Mean distance walked in 2 minutes of patients in group A and group B.

Table 4.5: Association of physical activity levels and functional performance measures in older adults across early mobilization and functional exercise groups.

		Group (A) with early mobilization and functional exercise program (N=50)	Group (B) without early mobilization and functional exercise program (N=50)	P-value
Type of physical activity	Low	10 (20%)	45 (90%)	**<0.001***
	Moderate	40 (80%)	5 (10%)	
		Mean ± SD	**Mean ± SD**	**P-value**
SF-IPAQ		556.16 ± 91.47	389.44 ± 85.7	**<0.001***
TUG		11.01 ± 1.24	12.31 ± 1.21	**<0.001***
		Median (IQR)	**Median (IQR)**	**P-value**
SPPB		12.0 (0.0)	10.0 (0.0)	**<0.001***

*: significant as P value ≤ 0.05

Regarding the type of physical activity, TUG and SPPB, there was a statistically significant difference between the early mobilization program groups. There was a statistically significant difference in the type of physical activity between the groups. Specifically, patients in group A 10 (20%) had a lower percentage of low physical activity compared to patients in group B 45 (90%), while patients in group A 40 (80%) had a higher percentage of moderate physical activity compared to patients in group B 5 (10%) (P<0.001). The patients in group (B) had a mean SF-IPAQ of 389.44 with an SD of 85.7, P<0.001, whereas the mean SF-IPAQ amount in group (A) was 556.16 with an SD of 91.47.

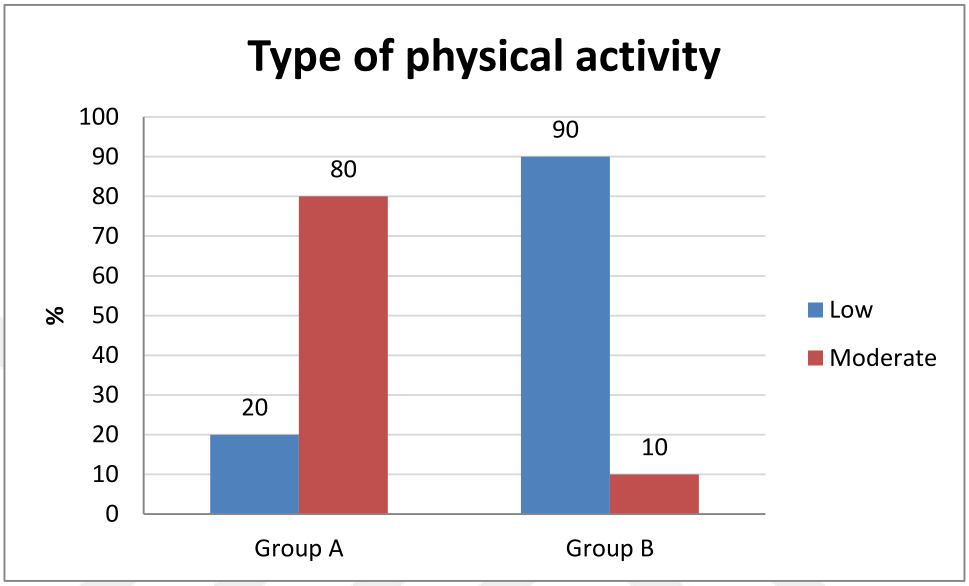


Figure 4.4: Type of physical activity of patients in group A and group B.

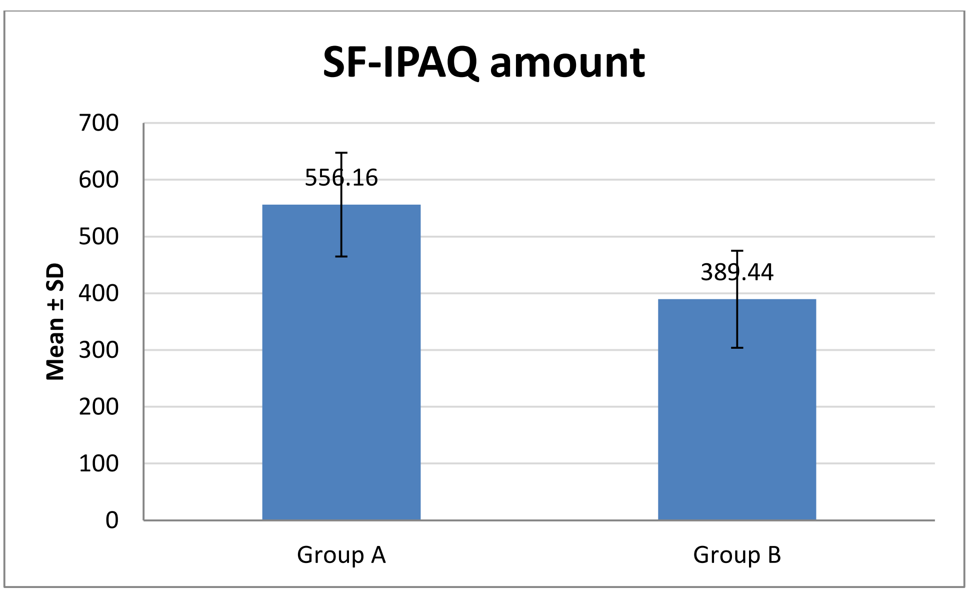


Figure 4.5: Mean SF-IPAQ number of patients in group A and group B.

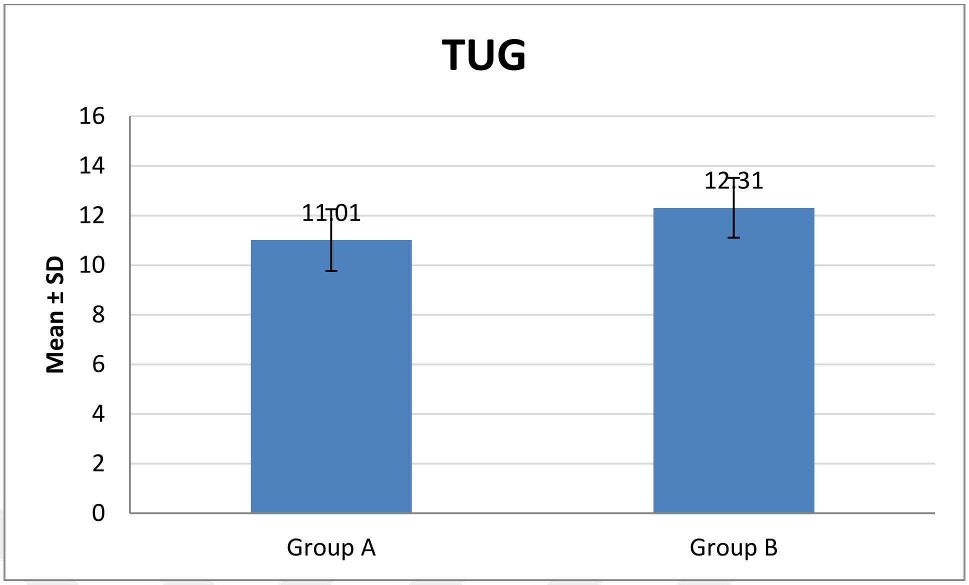


Figure 4.6: Mean TUG of patients in group A and group B.

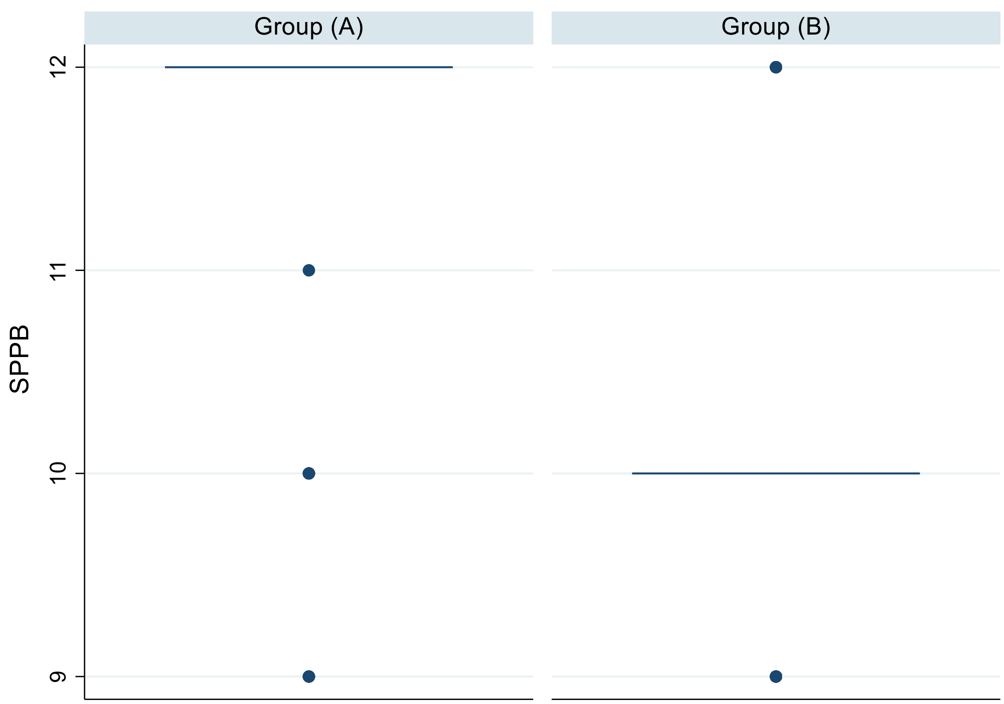


Figure 4.7: Median SPPB of patients in group A and group B.

Table 4.6: Correlation of 2MWT, SF-IPAQ, TUG, SPPB in group (B) patients without early mobilization and functional exercise.

Group (A) with early mobilization and functional ex (N=50)		**2 MWT**	**SF-IPAQ amount**	**TUG**	**SPPB**
Distance Walked in 2 minutes	Pearson Correlation	--			
	P-value				
SF-IPAQ amount	Pearson Correlation	0.957	--		
	P-value	**<0.001***			
TUG	Pearson Correlation	-0.768	-0.826	--	
	P-value	**<0.001***	**<0.001***		
SPPB	Spearman Correlation	0.918	0.955	-0.631	--
	P-value	**<0.001***	**<0.001***	**<0.001***	

*: significant as P value ≤ 0.05

A strong positive connection was indicated by the correlation coefficient of $r = 0.957$ ($p < 0.001$) between the amount of SF-IPAQ and 2 MWT. This result implies that the amount of SF-IPAQ grows in proportion to the distance walked in two minutes. Additionally, there was a significant negative association (correlation coefficient of $r = -0.768$; $p < 0.001$) between 2MWT and TUG. This finding suggests increased mobility and balance because it shows that the time required to complete the TUG test tends to decrease as the distance walked in two minutes increases.

Additionally, SF-IPAQ value and TUG were shown to be strongly correlated negatively (correlation coefficient: $r = -0.826$; $p < 0.001$). This result indicates that the TUG test takes less time to complete the higher the MET quantity, demonstrating improved mobility and balance. Between SPPB and 2 MWT and SF-IPAQ, a strong positive association was discovered; the correlation coefficients were $r = 0.918$ ($p < 0.001$) and $r = 0.955$ ($p < 0.001$), respectively. With a correlation coefficient of $r = -0.631$ ($p < 0.001$), a moderately negative association was discovered between SPPB and TUG.

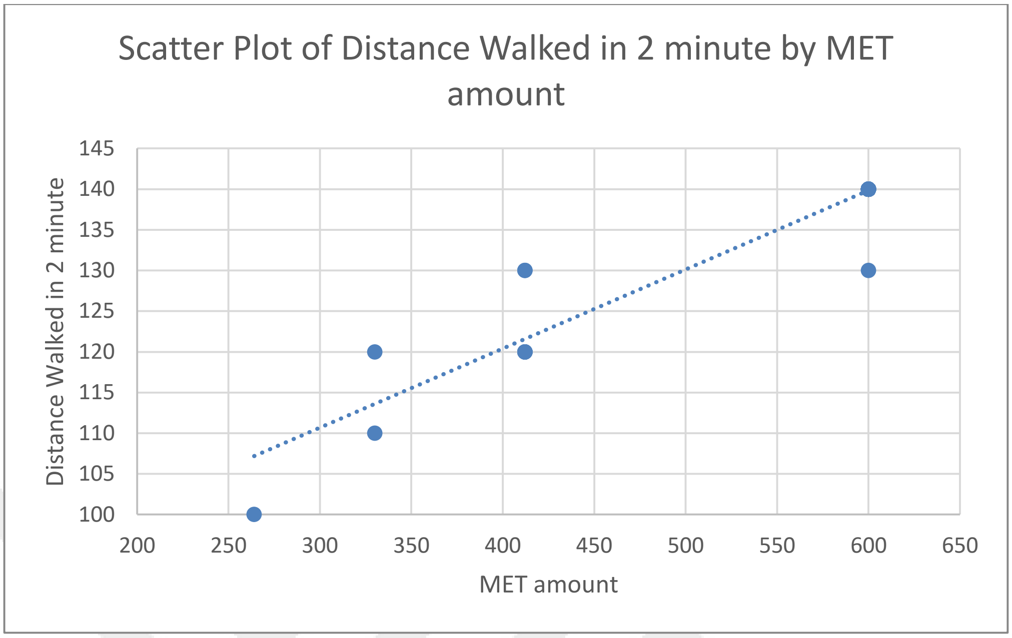


Figure 4.8: Scatterplot for 2MWT and SF-IPAQ amount for group (A) patients.

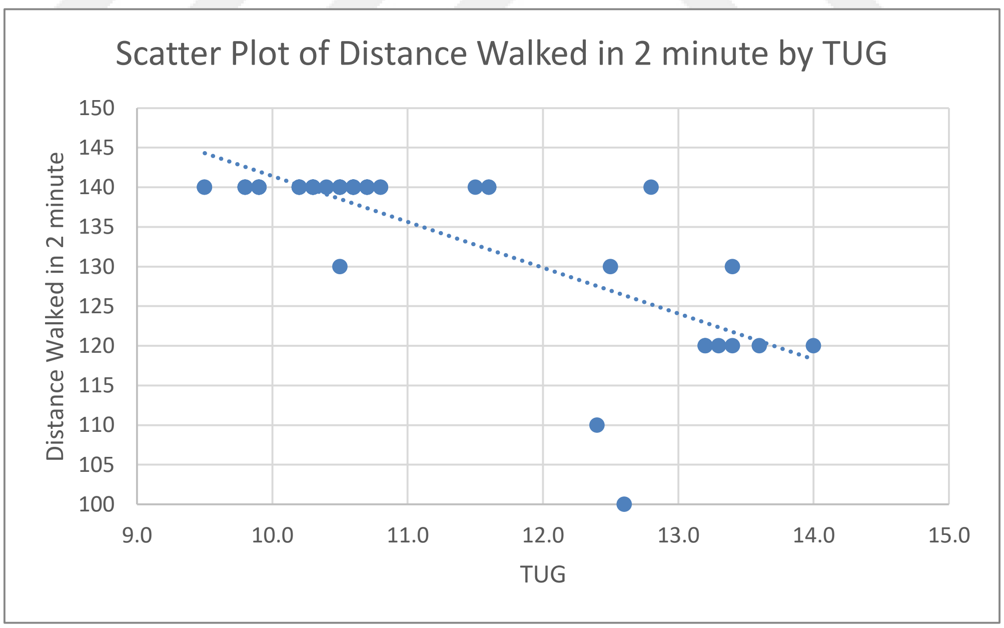


Figure 4.9: Scatterplot for 2MWT and TUG for group (A) patients.

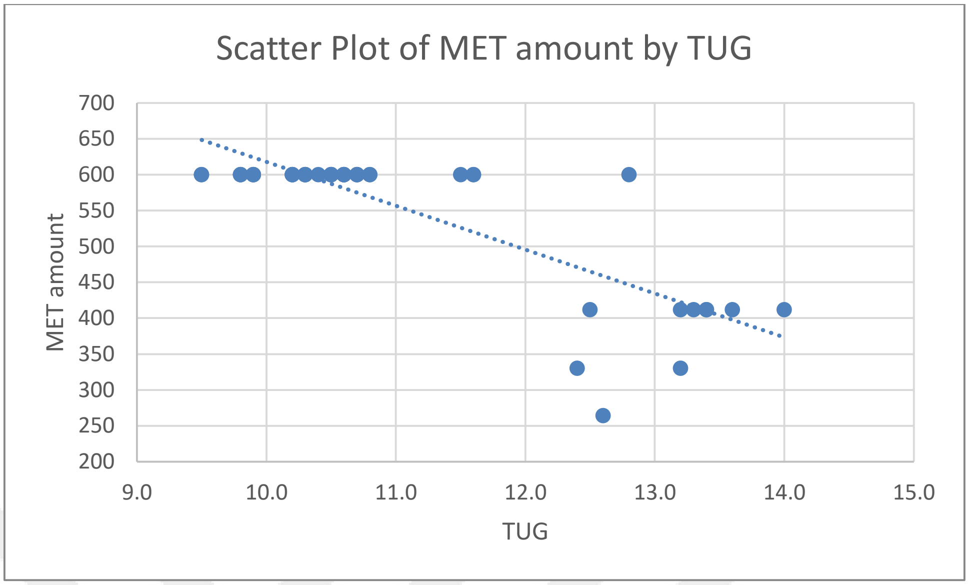


Figure 4.10: Scatterplot for SF-IPAQ amount and TUG for group (A) patients.

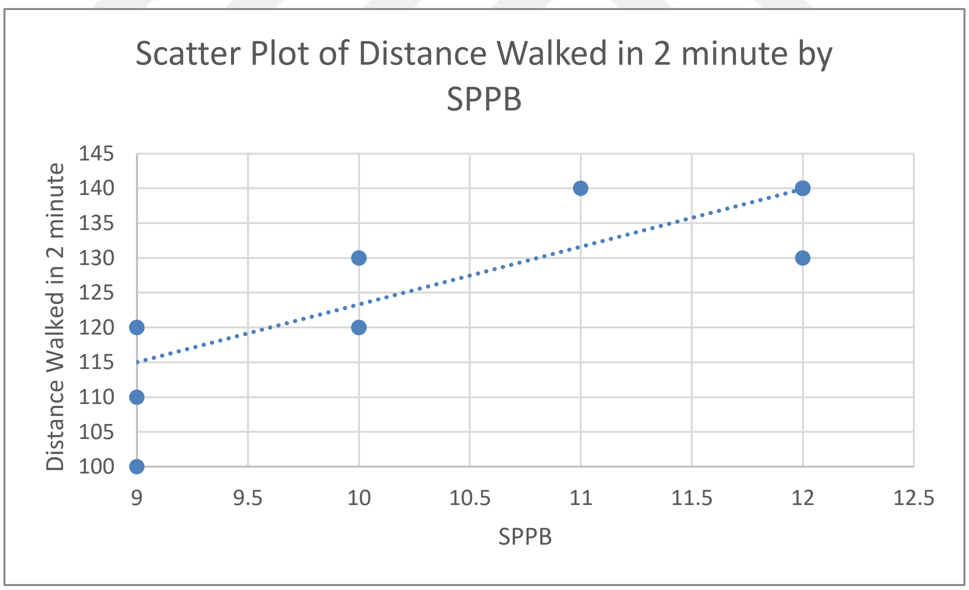


Figure 6.11: Scatterplot for 2MWT and SPPB for group (A) patients.

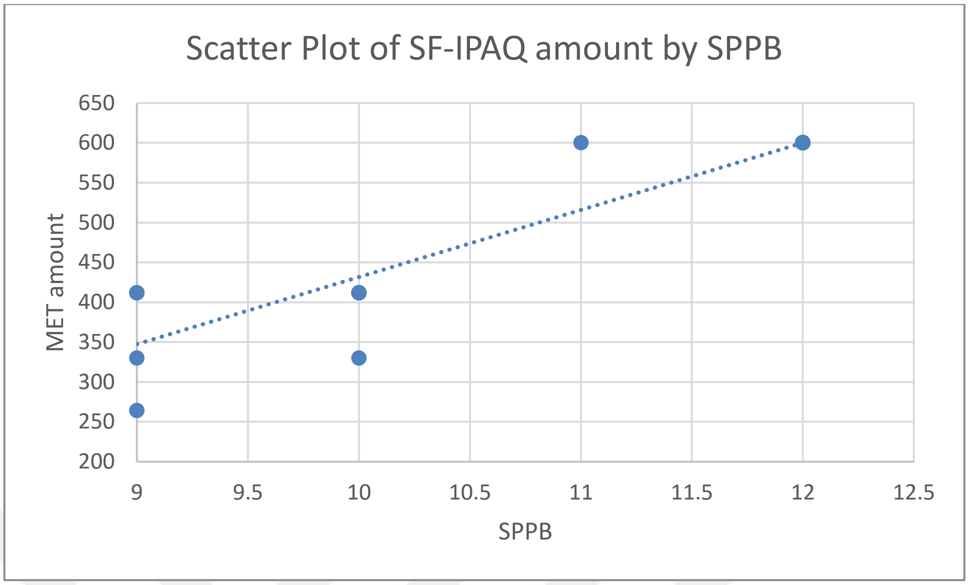


Figure 4.12: Scatterplot for SF-IPAQ amount and SPPB for group (A) patients.

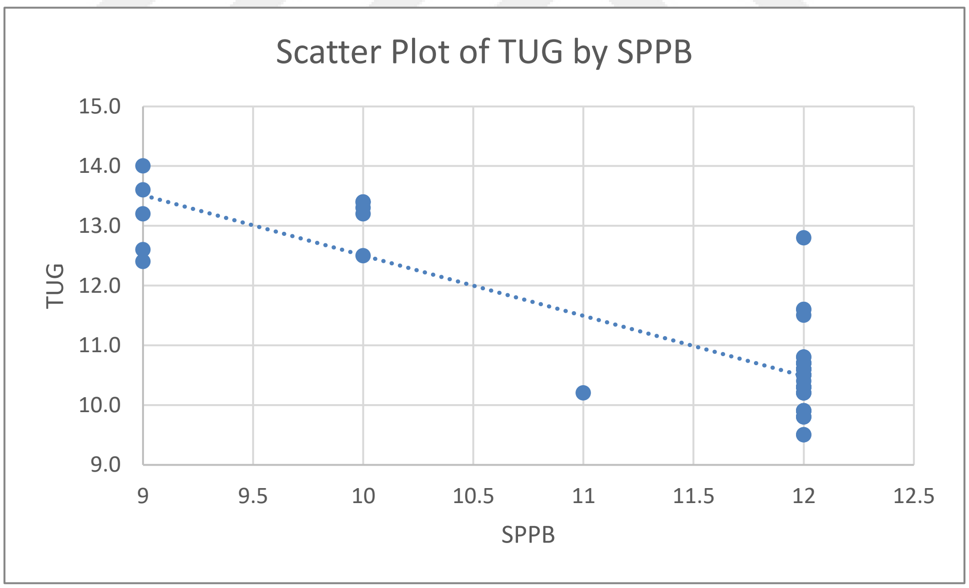


Figure 4.13: Scatterplot for TUG and SPPB for group (A) patients.

Table 4.7: Correlation of 2MWT, SF-IPAQ, TUG, SPPB in group (B) patients without early mobilization and functional exercise.

Group (B) without early mobilization and functional ex (N=50)		2MWT	SF-IPAQ amount	TUG	SPPB
Distance Walked in 2 minutes	Pearson Correlation	--			
	P-value				
SF-IPAQ	Pearson Correlation	0.746	--		
	P-value	**<0.001***			
TUG	Pearson Correlation	-0.278	-0.233	--	
	P-value	0.051	0.104		
SPPB	Spearman Correlation	0.574	0.414	-0.464	--
	P-value	**<0.001***	**<0.001***	**<0.001***	

*: significant as P value ≤ 0.05

Additionally, SF-IPAQ value and TUG were found strongly correlated negatively (correlation coefficient: r = -0.826; p < 0.001). This result indicates that the TUG test takes less time to complete the higher the MET quantity, demonstrating improved mobility and balance. Between SPPB and 2 MWT and SF-IPAQ, a strong positive association was discovered; the correlation coefficients were r = 0.918 (p < 0.001) and r = 0.955 (p < 0.001), respectively. With a correlation coefficient of r = -0.631 (p < 0.001), a moderately negative association was discovered between SPPB and TUG.

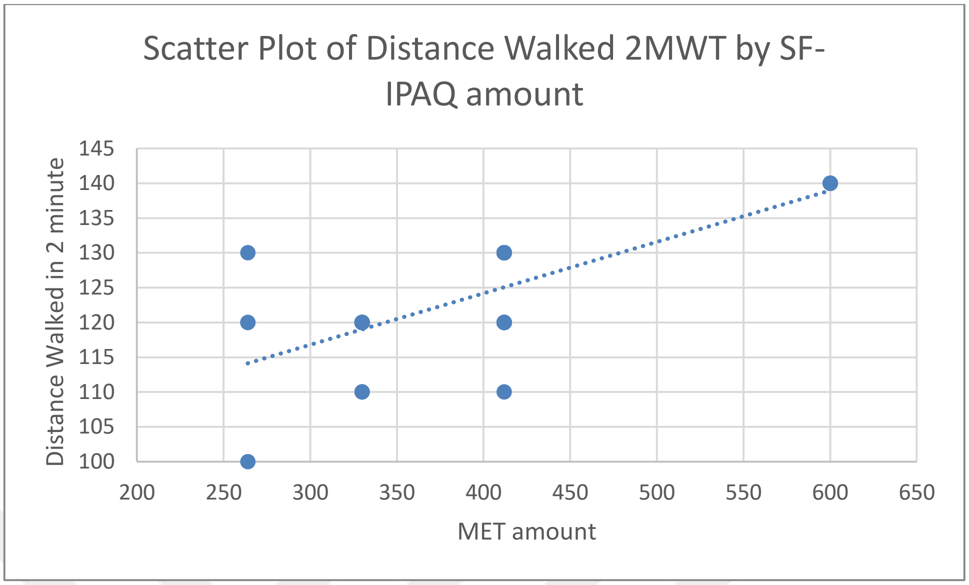


Figure 4.14: Scatterplot for 2MWT and SF-IPAQ amount for group (B) patients.

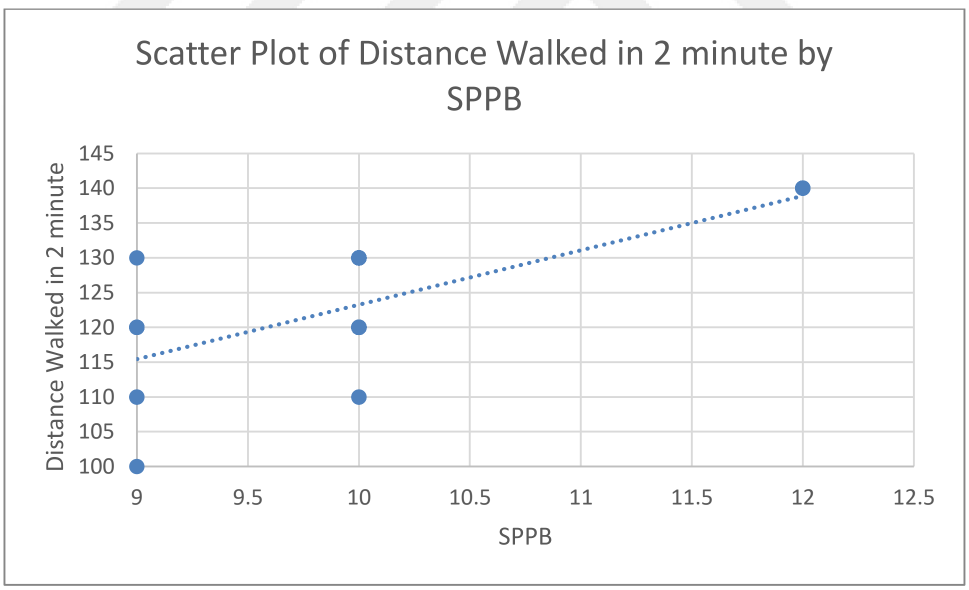


Figure 4.15: Scatterplot for 2MWT and SPPB for group (B) patients.

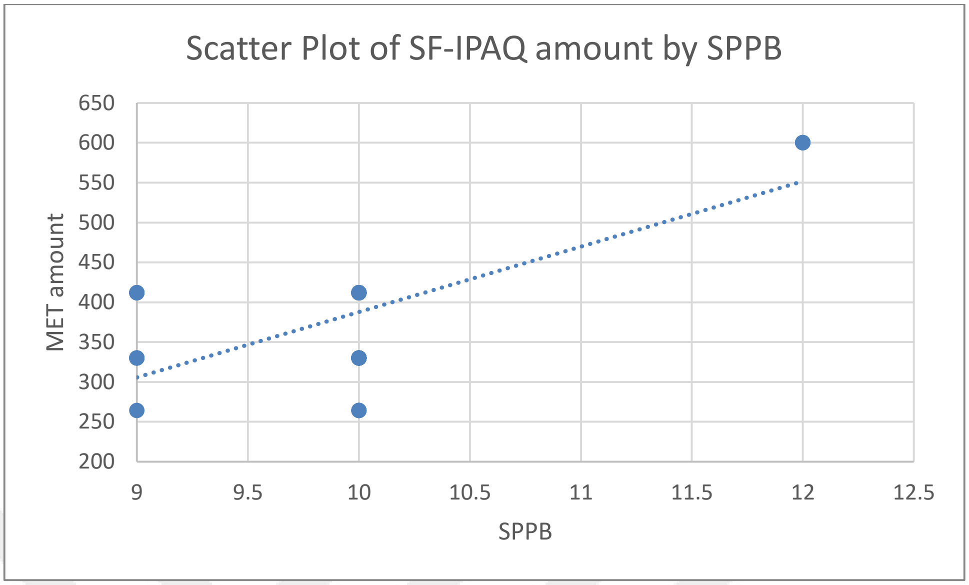


Figure 4.16: Scatterplot for SF-IPAQ and SPPB for group (B) patients.

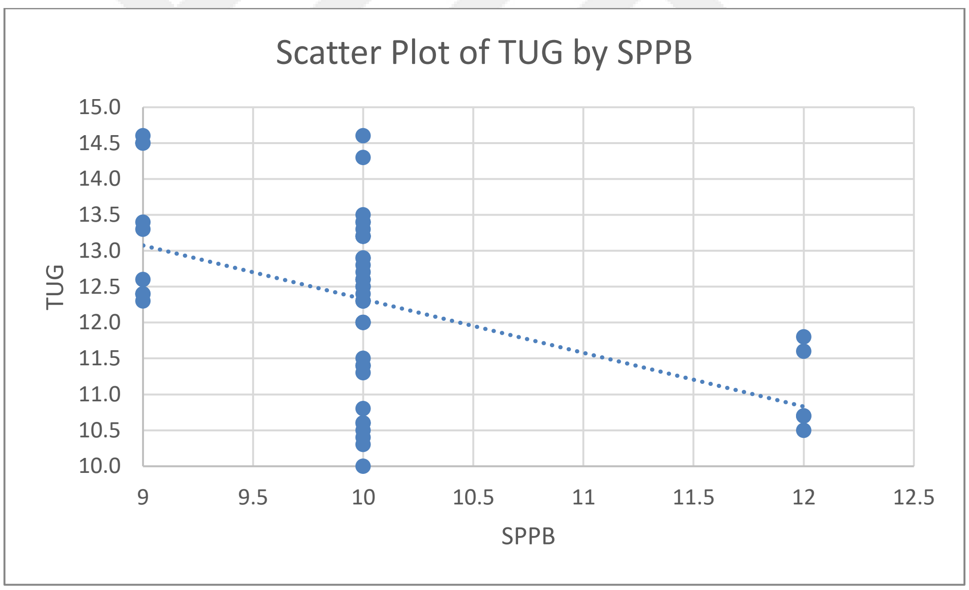


Figure 4.17: Scatterplot for TUG and SPPB for group (B) patients.

5. DISCUSSION

In this study, we examined how early mobilization and functional exercises affected patients' physical activity (PA), functional ability, and balance after heart surgery. The results of this study have shown that there is a statistically significant difference in weight and BMI between the early mobilization program group (Group A). In terms of the distance walked in two minutes, there was a statistically significant difference between the early mobilization group. Additionally, there was a statistically significant difference in the type of physical activity, SF-IPAQ, TUG, and SPPB scores between the early mobilization program group. In contrast to moderate physical activity, which was exhibited by a higher percentage of patients in Group A 40 (80%) than in Group B.

The prevalence of cardiovascular risk factors was found to be 23.7% for past smoking, 18.0% for current smoking, 56.7% for hypertension, 19.7% for diabetes, 38.3% for dyslipidemia, 39.0% for overweight, and 10.7% for obesity across the board in the sample, according to Macchi et al. (177). Our findings and these results showed a positive correlation. Our study's findings showed that there was a statistically significant difference between the early mobilization program groups in terms of the distance walked in two minutes, in Group A walking a greater distance in two minutes than Group B. The 2MWT, which assessed functional status, was associated with the early mobilization program group following cardiac surgery. According to Torres D. et al.'s (178) findings, patients who received early mobilization following heart surgery had higher functional capacities than those of the control group. The intervention group also showed improvements in functional capacity after seven days following cardiac surgery. This was consistent with our research, which shown that patients in Group A who underwent assessment on the seventh postoperative day after surgery had improved in terms of their functional capacity. Additionally, we assessed patients with 2MWT; in contrast, their study evaluated them using 6MWT.

According to a study, the cardiac postoperative 6MWT distance varied significantly between males and females. Men superior to women in terms of functional capacity, as measured by the 6MWT distance on the sixth post-operative day. Despite using different tests, this was consistent with the results of our investigation because the patients in it were elderly and so underwent testing using the 2-MWT (13).

According to Cui Z et al. (179), participants in the precision early ambulation (PEA) group walked significantly further on day 3 following cardiac surgery than those in the control group. PEA group members also covered significantly more ground than those in the control group. This is in line with the results of our investigation, despite the fact that our study evaluated participants on the seventh day following a variety of heart surgeries in older people, whereas their study evaluated participants on the third day following cardiac surgery.

According to Fiorina et al. (180), a person's functional capacity may be accurately determined by the distance they walked during the 6MWT. Following cardiac surgery, the distance walked increased significantly in the subgroup of patients who completed the 6MWT more than once. This was due to the cardiac rehabilitation program. This was consistent with our research, which found that patients assessed by 2MWT on the seventh day following cardiovascular surgery had improved in their functional capacity, and their study focused on participants who had taken part in a cardiac rehabilitation program by 6MWT 15 days after surgery. Walking and walking/breathing exercise groups had significantly longer 6MWT distances at hospital discharge compared to the conventional intervention group, according to Andrew D et al. (145). During the inpatient phase after CABG, a moderate-intensity walking program under the supervision of physical therapy improves functional ability upon hospital discharge. This was consistent with our findings, as patients were assessed using the 2MWT rather than the 6MWT.

Walking distance and functional independence were found to be considerably higher in the early mobilization group (Cordeiro A et al., 186). This was consistent with our research, which found that the early mobilization program group had greater functional capacity. According to Abdelaziz Mohammed F et al. (182), patients undergoing heart surgery had improved hemodynamic parameters and functional capacity as a result of the early ambulation program. These results supported the functional capacity values we obtained. When compared to conventional physiotherapy, aerobic exercise applied early in the intervention group on coronary artery bypass grafting patients may promote maintenance of functional capacity, with no impact on pulmonary function and respiratory muscle strength, according to Borges et al. (183), who also reported a significant difference in functional capacity found in the intervention group at hospital discharge. Although the rehabilitation programs in the two research differed, there was a minor correlation between this and our study.

According to Kanejima et al. (184), the objective variable in their meta-analysis of all trials included was the distance walked during the 6MWT at discharge. The meta-analysis's findings demonstrated a notably positive efficacy for early mobilization. In every study that was included, patients in the intervention group walked farther and longer during the 6MWT than those in the control group. Early mobilization increased the distance walked on the 6MWT at hospital discharge by 54.0 m (95% confidence interval: 31.1–76.9 m), as indicated by the mean differences results. This increase was a significant result of early mobilization.

These studies carried some similarities to our own, which assessed patients using the two-minute walk test on the seventh postoperative day and reported significant improvements in functional abilities following early mobilization in older patients undergoing heart surgery. Group A's two-minute walk time was significantly longer than group B's. According to Goldfarb M et al. (185), postoperative cardiac surgery patients' functional condition improved and a nurse-driven early mobilization (EM) program was safe. Despite the differences in the tests and questionnaires between the two research, these results were consistent with our own.

According to this study's findings, there was a statistically significant difference in the early mobilization program group's physical activity as measured by the SF-IPAQ. The type of physical activity also showed a statistically significant difference, with a higher percentage of patients in group A 40 (80%) reporting moderate physical activity than patients in group B 5 (10%), while a lower percentage of patients in group A 10 (20%) reported low physical activity compared to patients in group B 45 (90%).

Mungovan S et al.(13), There was a significant increase in both the PT-supervised and independent physical activity step counts at POD 5 compared with POD1 for males and females. There was a significant increase in both the PT-supervised and independent physical activity time METS ≥ 3 at POD5 compared with POD1 for males and females. Men exhibited significantly higher PT-supervised exercise and physical activity independent step counts and time ≥ 3 METS at POD5 compared with women. According to Mungovan S et al. (13), there was a substantial increase in the step counts for both males and females engaged in selfsufficient and supervised physical activity at post operative 5th day (POD5) in comparison with POD1. For both males and females, the supervised and independent physical activity time MET ≥ 3 increased significantly at POD5 in comparison to POD1. When it came to supervised exercise, men outperformed women in terms of independent step counts, physical activity, and time ≥ 3 MET at POD5.

This findings agreed with the results of our study. In their study, Mungovan S et al.(13) asserted that physical activity under the supervision of a physiotherapist promotes improvements in postoperative physiological functional capacity and shortens hospital stays after heart surgery. This was in line with our study's findings, which showed that the early mobilization program group's levels of physical activity had improved.

According to Jacob B. et al. (186), patients who underwent heart surgery had a gradual increase in early activity and mobilization, reaching 95% after the program was put in place. Additionally, patients' mean hours of out-of-bed mobilization before the intervention was 22.77, but this decreased to 11.74 after the procedure. Patients' first time out of bed mobilization time, mobility, and functional independence scores have all improved significantly after being transferred from the cardiothoracic intensive care unit (CTICU).

The mean FIM and IMS scores improved from 54.23 to 58.62 and from 3.96 to 7.23, respectively, indicating that the patients were mobilized ahead of schedule and before being transferred out of the CTICU, where they attained 89% functional independence as measured on the fifth postoperative day. We were also able to achieve a 47% reduction in the time required for the first out-of-bed mobilization. While their results indicated that patients were evaluated inside the cardiothoracic intensive care unit, our study looked at patients in the postoperative seventh day outside of the CTICU, and there were improvements in physical mobility for both studies. These results were in agreement with our findings.

According to Eder B et al. (187), older individuals recovering from cardiovascular surgery experience significantly better exercise tolerance when additional walking or cycling exercise training is added to normal cardiac rehabilitation programming. Despite the differences in the scales and therapy program, these results were comparable to ours.

Our study's results showed a significant negative association between SF-IPAQ and TUG scores. This finding implies that improved mobility and balance are indicated by a tendency for the TUG test's completion time to decrease as SF-IPAQ amount increases. Additionally, our findings demonstrated a high positive relation between the 2MWT and SF-IPAQ scores. This result implies that the amount of SF-IPAQ grows in proportion to the distance walked in two minutes.

Moreover, there was a significant negative connection found between 2MWT and TUG. This finding suggests increased mobility and balance because it shows that the time required to complete the TUG test tends to decrease as the distance walked in two minutes increases. We discussed some of our findings for balance, basic mobility abilities, and physical activity in different scales after cardiovascular surgery because, based on our fictional inquiry, we were unable to find studies linking TUG with SF-IPAQ scores following cardiac surgery.

On the fifth day following heart valve surgery, patients who received physiotherapy while in the hospital demonstrated higher levels of handgrip strength and physical activity in comparison to the control group, according to Chen J et al. (188). The handgrip strength test and the timed up and go test were used to measure physical activity. On the fifth post-operative day, the treatment group considerably outperformed the control group in terms of handgrip strength and timed up and go. This was consistent with our study's findings despite the different outcome measurement techniques.

According to Opasich C et al. (189), the individualized physiotherapy program that was subsequently developed to improve independent mobility shortly after cardiac surgery is safe, well-received, and more successful than standard physiotherapy for elderly-centered stratification based on functional frailty. This program also helps to identify patients who require more care and are more dependent on others. As a result, the frailty-based classification was effective in identifying patients who were more likely to fall, require extensive nursing care, be more dependent, and perceive their health worse.

When the groups were discharged, it was noted that both had greatly improved on every measure of mobility and independence; nevertheless, the majority of these improvements—including those related to nursing needs, mobility, balance, and muscle strength—were noticeably bigger in the intervention group. Additionally, the average period of stay for these patients was much shorter—91 percent of them were able to leave in a substantially independent state. Despite the different scales and qualification programs, these results were remarkably similar to ours.

The results of this study showed that there was a strong positive correlation was found between short physical performance battery (SPPB) and 2MWT and SF-IPAQ in group A, also, moderate negative correlation was found between SPPB and TUG in group A. Our structured physical activity intervention significantly improves the SPPB score in frail elderly patients who have undergone elective cardiac surgery.

According to Molino R et al. (176), older individuals who have had elective cardiac surgery may experience a delay in the onset of mobility handicap if they receive the benefits of an organized physical activity intervention that raises their SPPB score. The SPPB score of the intervention group (IG) significantly improved, whereas the control group (CG) did not significantly alter. Additionally, IG demonstrated a noticeably greater percentage of individuals who had at least a one-point improvement in their SPPB score. This aligned with the results of our investigation.

According to Ferronato L. et al. (190), in older people undergoing cardiac surgery, the SPPB raised the independent perceived execution (SPE) right away. Furthermore, it demonstrated little SPE changes, a low incidence of adverse effects, and strong dependability in older persons before and after cardiac surgery. Though our study investigated SPPB in two groups, their study evaluated SPPB pre- and postoperatively in one group following heart surgery, therefore our findings and theirs were roughly consistent.

Our review of the literature revealed no research on the relationship between the short physical performance battery (SPPB) and the 2MWT and SF-IPAQ, or between the SPPB and TUG utilized following heart surgery. As a result, we talked about some of our results for the SF-IPAQ and SPPB scores with other research that used other therapy programs and assessments following cardiac surgery.

Our study was limited in two ways. Firstly, because it was not appropriate for patients who had cardiac surgery, we were unable to perform isometric or isotonic strengthening exercises in the intensive care unit to enhance hand grasp. Our research shows quick and substantial since the

6MWT takes a long time and some older individuals are unable to finish it, it cannot be used with them; instead, 2MWT is used. Some patients were dropped from the functional exercise program due to their inability to complete the prescribed dosage.

6. CONCLUSION

We reached at the following conclusion based on our results:

1. Post-operative cardiac aged patients' improved physical activity is positively impacted by early mobilization and functional exercises.

2. After cardiac surgery, older patients' functional ability is positively impacted by early mobilization and functional exercises.

3. Elderly patients undergoing cardiac surgery experienced improved balance as a result of early mobilization and functional exercises.

4. Elderly patients who have had cardiac surgery benefit significantly from early mobilization and functional exercises; for this reason, it is imperative to encourage patients to participate in these activities following heart surgery.

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APPENDICES

Appx 1. Ethical Committee Approval

SAGLIK BAKANLIGI

BAGHDAD ALKARH SAĞLIK İDARESİ

INSAN VE EĞİTİM GELİŞİM DAİRESİ MERKEZİ

ARAŞTIRMA KURUL

KARAR NO: 903

KARAR TARIHI:14.12.2023

ARAŞTIRMA KURUL KARARI

BAGHDAD/ALKARH SAĞLIK İDARESİ DEPARTMANI ARAŞTIRMA KOMITESINCE ARAŞTIRMA TARAFINDAN SUNULAN ARAŞTIRMA PROJESİ İNCELENDİ NUMARASI (321056).

"EFFECTIVENESS OF EARLY MOBILIZATION AND FUNCTIONAL EXERCISE ON PHYSICAL ACTIVITY, FUNCTIONAL STATUS AND BALANCE POST OPERATIVE FOR ELDERLY CARDIAC PATIENTS".

ARAŞTIRMACI TARAFINDAN SUNULAN (AZHAR HASSAN MAHMOOD) MERKEZ EĞİTİM VE İNSAN GELİŞİMİ DEPARTMANI,BİLGİ YÖNETİMİ VE ARAŞTIRMA DEPARTMANINA SUNULMUŞTUR.BAGHDAD ALKARH SAĞLIK İDARESİ TARİH:13.12.2023.

KURULUN KARARI:

BU ARAŞTIRMA TEZ PROJESİ KURULUMUZ TARAFINDAN KABUL GÖREREK SAĞLIK BAKANLIĞI TARAFINDAN ONAYLANDI. ÖZEL ÇEVRE TEZ UYGULAMA MERKEZİ BU KONUDA UYGULAMAYA ENGEL YOKTUR MERKEZİN ADI KALP CERRAHİ BRANŞ MERKEZİ. BU TEZİN ARAŞTIRMASINDA VE UYGULAMASINDA BİR ENGEL BULUNMAMAKTADIR.

ARAŞTIRMA KURUL MÜDÜRÜ

KURUL BAŞKANI

IMZA14.12.2023

FAKÜLTE BRANŞ DOKTORU

SUAD KAMİL RAHEEM

IMZA

Appx 2. Demographic Information Questionnaire

PATIENT REGISTRATION INFORMATION
PLEASE PRINT AND COMPLETE ALL SECTIONS OF THIS FORM

LAST NAME ____________________ FIRST NAME ____________________ INITIAL ______

DATE OF BIRTH ______________ SEX ☐ M ☐ F SOCIAL SECURITY ______________

MARITAL STATUS ☐ S ☐ M ☐ W ☐ D ☐ Other ______________

ADDRESS ______________ CITY ______________ STATE ______ ZIP ______

HOME PHONE ______________ CELL ______________ EMAIL ADDRESS ______________

SPOUSE NAME ______________ INSURANCE COMPANY ______________

RACE ☐ White ☐ Black ☐ Asian ☐ Native Hawaiian/Pacific Islander ☐ American Indian/Alaskan Native ☐ Hispanic ☐ Other

ETHNICITY ☐ Hispanic/Latino ☐ Non-Hispanic/Latino ☐ Unreported/Refused

LANGUAGE ☐ English ☐ Spanish ☐ French ☐ Arabic ☐ Chinese ☐ Sign Language

EMPLOYER ______________ WORK PHONE ______________

Responsible Party Information *(for patients under 18 and other dependent patients)*

Name: ______________ (Last / First / Middle Initial) Relationship to patient: ______________

Address: ______________ City: ______________ State: ______ Zip: ______

DOB: ______________ (MM/DD/YYYY) **Sex:** ☐F ☐M Phone: ______________ ☐Home ☐Cell ☐Other

Emergency Contact

Name: ______________ Phone: ______________ Relationship to patient: ______________

Patient's Insurance Information	
Primary Policy: ______________	Secondary Policy: ______________
Policy Holder: ______________	Policy Holder: ______________
Date of Birth: ______________	Date of Birth: ______________
Relationship to Patient: ______________	Relationship to Patient: ______________

Appx 3. Short Form International Physical Activity Questionnaire (SF-IPAQ

IPAQ Scoring Protocol (Short Versions)

Categorical Score- three levels of physical activity are proposed

1. *Inactive*

   - No activity is reported **OR**
   - Some activity is reported but not enough to meet Categories 2 or 3.

2. *Minimally Active*

   Any one of the following 3 criteria

   - 3 or more days of vigorous activity of at least 20 minutes per day **OR**
   - 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day **OR**
   - 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-min/week.

3. *HEPA active*

   Any one of the following 2 criteria

   - Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week **OR**
   - 7 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 3000 MET-minutes/week

Continuous Score

Expressed as MET-min per week: MET level x minutes of activity x events per week

Sample Calculation

MET levels	**MET-min/week for 30 min episodes, 5 times/week**
Walking = 3.3 METs	3.3*30*5 = 495 MET-min/week
Moderate Intensity = 4.0 METs	4.0*30*5 = 600 MET-min/week
Vigorous Intensity = 8.0 METs	8.0*30*5 = 1,200 MET-min/week
	TOTAL = 2,295 MET-min/week

Total MET-min/week = (Walk METs*min*days) + (Mod METs*min*days) + Vig METs*min*days)

Please review the document "Guidelines for the data processing and analysis of the International Physical Activity Questionnaire (Short Form)" for more detailed description of IPAQ analysis and recommendations for data cleaning and processing [www.ipaq.ki.se].

Appx 4. Two Minute Walk Test (2MWT)

2 Minute Walk Test Instructions

General Information:

- individual walks without assistance for 2 minutes and the distance is measured
  - start timing when the individual is instructed to "Go"
  - stop timing at 2 minutes
  - assistive devices can be used but should be kept consistent and documented from test to test
  - if physical assistance is required to walk, this should not be performed
  - a measuring wheel is helpful to determine distance walked
- should be performed at the fastest speed possible

Set-up and equipment:

- ensure the hallway free of obstacles
- stopwatch

Patient Instructions (derived from references below):

"Cover as much ground as possible over 2 minutes. Walk continuously if possible, but do not be concerned if you need to slow down or stop to rest. The goal is to feel at the end of the test that more ground could not have been covered in the 2 minutes."

Appx 5. Time up Go Test

Timed Up and Go (TUG) Test

Description: Measure of function with correlates to balance and fall risk

Equipment: Stopwatch, Standard Chair, Measured distance of 3 meters (10 feet)

Patient Instructions: "My commands for this test are going to be 'ready, set, go'. When I say go, I want you to stand up from the chair. You may use the arms of the chair to stand up or sit down. Once you are up, you may take any path you like, but I want you to move as QUICKLY as you feel safe and comfortable until you pass this piece of tape (or end of marked course) with both feet. Turn around and walk back to the chair. I will stop the clock when your back touches the back of the chair. You will complete one practice run and two that are counted."

Therapist Instructions: Start timing on the word "GO" and stop timing when the subject is seated again correctly in the chair with their back resting on the back of the chair. The subject wears their regular footwear, may use any gait aid that they normally use during ambulation, but may not be assisted by another person. There is no time limit. They may stop and rest (but not sit down) if they need to.

Interpretation:

≤ 10 seconds = normal

≤ 20 seconds = good mobility, can go out alone, mobile without gait aid

≤ 30 seconds = problems, cannot go outside alone, requires gait aid

* A score of ≥ 14 seconds has been shown to indicate high risk of falls

Appx 6. Short Physical Performance Battery

Short Physical Performance Battery (SPPB) - Protocol

The Test explained

The short physical performance battery (SPPB) is a group of measures that combines the results of the gait speed, chair stand and balance tests (Guralnik et al., 2000). It has been used as a predictive tool for possible disability and can aid in the monitoring of function in older people. The scores range from 0 (worst performance) to 12 (best performance). The SPPB has been shown to have predictive validity showing a gradient of risk for mortality, nursing home admission, and disability.

Setting

Physiotherapy cubicle

Equipment Required

Chair with arms 18-19” in height	Stopwatch	Tape measure	2 cones to mark 2.44m

CURRICULUM VITAE

Personal Information		
Name and surname	Azhar Hassan MAHMOOD	
Place of birth	Iraq, Baghdad	

License	
University	Baghdad
Faculty	Medical Technology College
Department	Physical Therapy And Rehabilition
Graduation Year	2014

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