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**The Effectiveness of Proactive Balance Training Program in
Prevention of Falling Among Elderly in Golden Care**

Rehabilitation Center

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**The Effectiveness of Proactive Balance Training Program in
Prevention of Falling Among Elderly in Golden Care
Rehabilitation Center**

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**This thesis was submitted in partial fulfillment of the
requirements for the degree of Master in Physiotherapy**

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Thesis Approval

**The effectiveness of proactive balance training program in
prevention of falling among elderly in Golden Care rehabilitation
center**

Prospective Cohort Study

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1445/2023

Dedication

This thesis is entirely dedicated to my beautiful family, especially to my wonderful husband "Adi" who has acted as an inspiration, a big supporter, and who has made everything possible, as well as to my sunshine son "Ahmad". They continuously provided their moral, spiritual, and emotional support, and they assisted me in overcoming my worries. I also dedicate this work to Marwa and Raed, my beloved parents, whose words of support and push for determination still ring in my ears. My parents-in-law and siblings, thank you for your encouragement and support till I completed my higher education.

Declaration

This thesis is submitted in partial fulfillment of the requirement for the Master's degree in Physiotherapy.

I declare that the content of this thesis (or any part of the same) has not been submitted for a higher degree to any other University or institution.

Signed : *Ayda Hamdan*

Date: 18/09/2023

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The effectiveness of proactive balance training program in prevention of falling among elderly in Golden Care Rehabilitation Center

By: Ayda Raed Mahmmoud Hamdan

Supervisor: Akram Amro

Abstract

Background: Elderly have a serious issue when their balance deteriorates due to physiological changes with aging, which increases their risk of falling. The purpose of the study was to assess how effectively a proactive balance training program works in preventing older adults from falling.

Methods: a prospective cohort design was conducted with 42 patients from the Golden Care Rehabilitation Center. Data Collection Sheet, TUG, BBS, 10MWT, FES-I, and FRT were used to compare all balance abilities before beginning the rehabilitation program and after 8 weeks.

Results: There was no association between improvement at any of the outcome measures with gender, prevalence of comorbidities, or association with any of the anthropometric variables, except for age which showed a negative correlation with improvement BBS and positive with TUG and FES. TUG, 10MWT, BBS, and FES-I were statistically significant improved between the pre-post-tests ($P < 0.01$). The main predictors of TUG improvement were age and pre-test TUG. The primary predictors of BBS improvement were age and the pre-BBS test. Pre-test FES, gender, and pre-test BBS were the main predictors of FRT improvement. The key predictors of FES progress were age and pre-FES. In correlation between the outcomes measures, A significant positive correlation between TUG and 10MWT, TUG and FES, FRT and BBS ($P < 0.05$). A negative correlation between TUG and BBS, TUG and FRT, FRT and FES, BBS and FES ($P < 0.01$). While, no significant correlation between 10MWT and FRT, 10MWT and BBS, or 10MWT and FES ($P > 0.05$).

***Keywords:** Proactive, Balance Training, falls, falling, aging, postural control, elderly, dysfunction, older adults, training program

فاعلية برنامج التدريب على التوازن الاستباقي في الوقاية من السقوط بين كبار السن في مراكز تأهيل كبار السن

ملخص باللغة العربية

اعداد: عايدة راند محمود حمدان

بإشراف: د. أكرم عمرو

المقدمة: قد يؤدي التدهور الفسيولوجي لدى كبار السن إلى تراجع التوازن وزيادة فرصة السقوط، الأمر الذي قد يصبح مشكلة كبيرة بالنسبة لكبار السن. الهدف من هذه الدراسة هو تقييم مدى فعالية برنامج تدريب التوازن الاستباقي في منع كبار السن من السقوط.

الأساليب: اعتمدت الدراسة الحالية تصميم طولية المستقبلية، حيث قمنا بتعيين 42 مريضاً (23 ذكراً و19 أنثى) من مركز تأهيل الرعاية الذهبية في يافا، والذي يهدف إلى تقييم فعالية برنامج التدريب على التوازن الاستباقي في منع السقوط بين كبار السن. تم استخدام ورقة جمع البيانات، وفحص انهض وانطلق (TUG)، ومقياس بيرج للتوازن (BBS)، واختبار المشي لمسافة 10 أمتار (10MWT)، ومقياس فعالية السقوط الدولي ((FES-I)، واختبار الوصول الوظيفي (FRT) للمقارنة جميع قدرات التوازن قبل البدء ببرنامج إعادة التأهيل (الاختبارات المسبقة) وبعد 8 أسابيع (الاختبارات اللاحقة).

النتائج: وجدت الدراسة أنه لا يوجد ارتباط بين التحسن في أي من مقاييس النتائج، مع الجنس، وانتشار الأمراض المصاحبة، ولا ارتباط مع أي من المتغيرات القياسات البشرية، باستثناء العمر الذي أظهر ارتباطاً سلبياً مع تحسن مقياس بيرج للتوازن وإيجابياً مع TUG فحص انهض وانطلق ومقياس فعالية السقوط الدولي. بالإضافة إلى ذلك، تحسن فحص "انهض وانطلق" (TUG) بشكل ملحوظ بين الاختبار القبلي والاختبار البعدي. ($P < 0.01$) وكان المتنبئين الرئيسيين لتحسن هذا الفحص هم العمر والاختبار القبلي ل TUG. تحسن مقياس بيرج (BBS) للتوازن احصائياً بين الاختبار القبلي والاختبار البعدي ($P < 0.01$)، وكانت المتنبئات الأولية لتحسن BBS هي العمر واختبار ما قبل BBS. كان التحسن في اختبار الوصول الوظيفي (FRT) بين خط الأساس والاختبار البعدي ذا دلالة إحصائية. ($P < 0.01$) وكان الفحص القبلي لمقياس فعالية السقوط الدولي، والجنس، والفحص القبلي لمقياس بيرج للتوازن هي المتنبئات الرئيسية لتحسين اختبار الوصول الوظيفي (FRT). تحسن مقياس فعالية السقوط الدولي بشكل ملحوظ بين الاختبار القبلي والبعدي. ($P < 0.01$) كانت المتنبئات الرئيسية لتحسن هذا الفحص هي العمر والفحص القبلي. FES وبالنسبة للارتباط بين أدوات التقييم، كان هناك ارتباط إيجابي بين TUG و10MWT وبين TUG وFES ($P < 0.05$). وكان هناك ارتباط سلبى بين TUG وBBS، وبين TUG وFRT، وبين FRT وFES، وبين BBS وFES وبين FRT وBBS ($P < 0.01$). بينما لم يكن هناك ارتباط كبير بين 10MWT وFRT، وبين 10MWT وBBS، أو بين 10MWT وFES ($P > 0.05$).

***الكلمات المفتاحية:** استباقي، تدريب التوازن، السقوط، الشيخوخة، التحكم في وضعية الجسم، كبار

السن، الخلل الوظيفي، كبار السن، برنامج تدريب

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1. Chapter One

Introduction

1.1 Introduction

1.2 Theoretical Frame Work

1.3 Problem Statement

1.4 Research Hypothesis

1.5 Research Questions

1.6 Primary Research Aim

1.7 Study Justification

1.8 Terminology and abbreviations

Chapter One

1.1 Introduction:

Falls are considered the main cause of morbidity and mortality in older individuals (Sherrington et al, 2017)¹. The risk of falling rises with age, and around one in three community-dwelling individuals 65 years of age and over, will experience at least one fall per year (Lord, Ward, Williams & Anstey,1993)². Individuals, their families, community health services, and the economy all pay a heavy social and financial burden as a result of falls (Sherrington et al, 2017)⁽¹⁾. The costs related to falls will rise as the percentage of older people increases around the world (Alamgir, Muazzam & Nasrullah, 2012)⁽³⁾.

For older persons, balance is essential to the majority of daily tasks, including housework, cooking, shopping, and travel (Judge, Schechtman, Cress, & Group, 1996)⁽⁴⁾. For continued health and wellbeing, it's essential to maintain a good feeling of autonomy. Poor balance is a primary risk factor for falls, a main cause of hospitalization and nursing care requirements (Sturnieks, George, Fitzpatrick, & Lord, 2008)⁽⁵⁾.

The brain, muscles, bones, nerves, and inner ear all collaborate to keep people balanced and alert from a fall. The systems model integrates both motor and sensory techniques to maintain static and dynamic balance, focusing on a dynamic interplay among many systems. Sensory inputs, sensorimotor integration by the central nervous system, and postural reactions all play a role in this complicated integration process. And These characteristics may be impacted by aging, resulting in deficiencies in balance and gait (Martin et al., 2013)⁽⁶⁾.

According to Shumway-Cook and Woollacott, balance can be subdivided into three different types, including **static/ dynamic steady-state** which refers to the capacity to maintain balance under conditions that are largely predictable and constant (i.e., maintaining a steady position in walking, sitting, standing). Secondly, **reactive balance** is known as the capacity to resume a stable stance after an unexpected stimulus (i.e., compensation of a disturbance). Thirdly, **proactive balance** which is known as the capacity to activate the muscles in the legs and trunk for balance management before potentially unsteady voluntary movements (i.e., anticipation of a predicted disturbance). Moreover, Balance results from the interaction of the individual, the task,

and the environment. constraints imposed by the environment, including the type of support surface, sensory signals, and cognitive demands. variations among people, including their motor, sensory, and cognitive capacities (Shumway & Wollacott, 2016) (7).

In healthy older adults, Gillespie et al. were able to prove that there is no significant correlation between measurements of steady-state, proactive, and reactive balance. While There is clear evidence that carefully designed effective interventions can save older adults from falling (Gillespie et al, 2012) (8). Exercise interventions have been shown to lower the rate of falls and risk of falls in community-dwelling older people, according to a Cochrane systematic review by Gillespie et al. Exercise as a stand-alone intervention may be the best method of fall prevention at the population level since it has a fall prevention effect comparable to that of multimodal interventions (Gillespie et al, 2012) (8).

The majority of physical therapy interventions, as well as many community fitness and wellness programs, implement proactive balance training, which is a self-directed, anticipatory method of strengthening and balancing exercises, to enhance balance and prevent falls (Sadowski, Christina, Espy & Deborah, 2012) (9). Contrarily, reactive balance training involves practicing responses to unexpected changes that result in balance losses, such as a slip, trip, or nudge (Sadowski, Christina, Espy & Deborah, 2012) (9). It is unknown to what level skills acquired in proactive conditions translate to reactive situations. Research is required to evaluate this transfer and determine the best training methods for preventing falls (20). Proactive training may be less demanding on a person's balance control systems than reactive tasks because it is self-initiated (lower amplitude disturbances) make it easier to use in rehabilitation settings (Sadowski, Christina, Espy & Deborah, 2012) (9).

Consequently, preventing falls is a pressing public health issue (Sherrington et al, 2017)(1). Sufficiently developed intervention programs including balance and strengthening exercises that are recognized to stop falls in older adults are being promoted for implementation by national health agencies and international standards (Sherrington et al, 2017)¹. Exercise has been shown to reduce the risk of falling. Even people who are older than 80 years old can benefit from exercise. According to Petridou et al. (31), exercise-alone therapies were around five times more effective than

multimodal interventions at reducing recurrent falls among older persons living in the community. Encouragement of exercise among elderly persons should therefore be advantageous. A meta-analysis of the seven Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT) exercise trials shows that balance exercise may be more beneficial than the other exercise components at reducing the risk of falls among multimodal treatments (Province et al., 1995)⁽³²⁾.

1.2 Theoretical Frame Work

As shown in Figure 1.1, conceptual framework and analytic strategy used to clarify the study process.

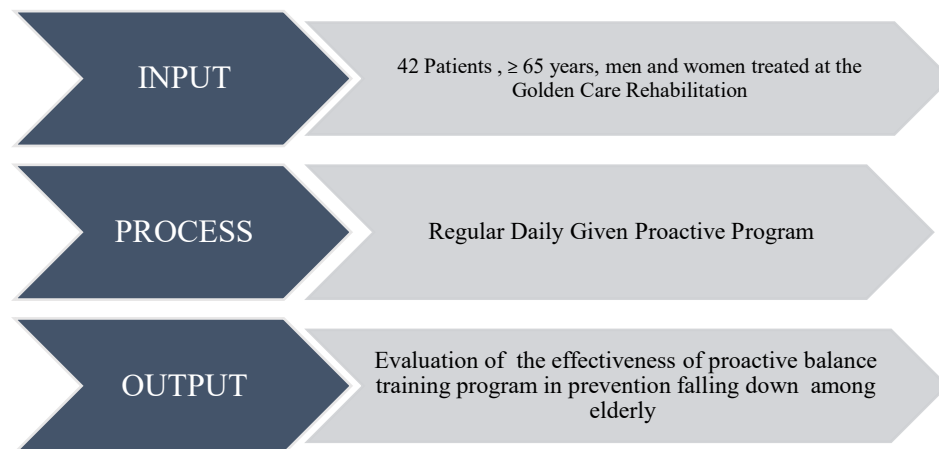


Figure 0.1 Conceptual framework and the analytic strategy

1.3 Problem Statement:

The concern of elderly people falling has a high incidence, a high risk of injury, and a rising risk group (Alamgir, Muazzam & Nasrullah, 2012)⁽³⁾. Each year, 28.7% of elders over 65 experience a fall. That results in 29 million falls nationwide, 27,000 fatalities, and 7 million injuries that require medical attention (Alamgir, Muazzam & Nasrullah, 2012)⁽³⁾. Therefore, we should have strategies that have been successfully demonstrated to reduce the risk or incidence of falls. Consequently, the risk of death from falls has gone above and beyond what we would predict given the growing population of older adults. A portion of this rise may be explained by longer lifespans and more chronic diseases (Alamgir, Muazzam & Nasrullah, 2012)⁽³⁾. There were 24,190 fatal falls in 2012, while 3.2 million non-fatal ones required medical attention.

Direct medical expenses for fatal injuries totaled \$616.5 million and non-fatal injuries totaled \$30.3 billion in 2012; by 2015, they had increased to \$637.5 million and \$31.3 billion, respectively. Age-related increases in fall incidence and overall cost were greater in women (Gillespie et al., 2012)⁽⁸⁾.

Furthermore, falls frequently result from poor responses to stimuli from the outside world (Sadowski, Christina, Espy & Deborah, 2012)⁽⁹⁾. Reactive perturbation training is being investigated significantly more than proactive balance as a result of how reactive balance training and falls that occur in real life are more similar (Sadowski, Christina, Espy & Deborah, 2012)⁽⁹⁾. As a result, developing proactive balance training within the environment of global care is both practical and effective (Sadowski, Christina, Espy & Deborah, 2012)⁽⁹⁾.

In Palestine, there is a dearth of knowledge related to the effectiveness of providing proactive balance training. A deep understanding of proactive balance training's effectiveness is needed to lower risk and stop falling down. This study aims to highlight the effectiveness of such a program.

1.4 Research Hypothesis:

Null hypothesis: There is no effect of proactive balance training program(PBTP) in preventing falling down and improving gbalance among elderly.

Alternative: There is a statistically significant positive effect of proactive balance training program in preventing falling down and balance among elderly.

1.5 Research Questions:

1. Is there an effect of the proactive balance training program in preventing falling down and improving balance among elderly?
2. Are there specific factors and predictors contributing to better improvement of balance among elderly?
3. Is there an association between different balance outcomes measures?

1.6 Primary Research Aim:

The aim of the study is to evaluate the effectiveness of a proactive balance training program in preventing of falling down among the elderly.

1.7 Study Justification:

The findings of this study will lead to the best rehabilitation in the geriatric field and decreasing costs for treating the elderly by highlighting the importance of proactive training on balance and its association with decreasing of falling down risks due to its simplicity, lesser threat to participants' safety, higher acceptability by participants, and cheaper cost way to prevent falling down, and this will be beneficial for both elderly community, caregivers and therapists. However, Management must change from a negative philosophy of rest and general exercises to a more effective active restoration of function. Which lead to raising the awareness of patients and physicians by making them pay more attention to the role of physiotherapy by focusing on specific interventions in preventing falling down. However, Physical Therapists should be in charge of the overall care process. The patient should be kept well informed over the entire course of his illness and should be encouraged to adopt a healthful lifestyle, including regular physical exercises, especially if he is elderly.

1.9 Terminology and Abbreviations:

PBTP: Proactive Balance Training Program

TUG: Time UP and Go

BBS: Berg Balance Scale

FES-I: Fall Efficacy Scale –International

FRT: Functional Reaching Test

DM: Diabetes Mellitus

HTN: Hypertension

HD: Heart Diseases

BoS: Base of Support

SD: Standard Deviation

M: Mean

Max: Maximum

Min: Minimum

2. Chapter Two

Literature Review

2.1 Background

2.2 Similar studies

Chapter Two

2.1 Background:

2.1.1 Background & Definition

According to World Health Organization, falls considered as the second most common reason for accidental deaths in the world, after traffic accidents (WHO, 2021) ⁽¹⁰⁾. Worldwide, the number of fatal falls is estimated at 646,000 individuals. 28–35% of those over 65 experience a fall each year, and this incidence rises to 3–42% for those over 60, according to the WHO worldwide study from April, 2021⁽⁷⁾. A fall is known as an event that causes a person to accidentally come to rest on the ground, a floor, or another lower level. Fall-related injuries can be fatal or not. However, the majority of fall-related injuries are not fatal (WHO, 2021) ⁽¹⁰⁾.

However, Balance is identified as the person's capacity to control their center of gravity within the boundaries of their Base of Support (BOS) (Sturnieks, 2021) ⁽¹¹⁾. It can also be characterized as having the capacity to maintain equilibrium. Additionally, processing sensory information from the vestibular, ocular, and proprioceptive systems in the cerebral cortex is a complex bodily process that controls posture and movement during body balance control (Neptune & Vistamehr, 2018) ⁽¹²⁾. A person's ability to maintain static and dynamic balance may be negatively impacted by aging, neurovascular conditions, inadequate muscle strength, restricted range of motion, and cognitive loss, which increases the risk of falling and reduces their capacity to do daily chores (ADLs) (Saftari & Kwon, 2018) ⁽¹³⁾.

2.1.2 Risk Factors for falling

Age-related declines in physical, sensory, and cognitive abilities make elderly people more susceptible to falls (Deschamps, Le Goff, Berrut, Cornu, & Mignardot, 2016) ⁽¹⁴⁾. In an effort to better understand the causes of falls and suggest strategies for preventing them, numerous studies have revealed a variety of fall risk factors (Sturnieks, 2021) ⁽¹¹⁾. Other studies clarifies the main causes of the rise in fall risks in older persons have been considered to include the ability to control balance and gait , musculoskeletal functions , cardiovascular functions , vestibular functions , somatosensory functions [13, 14], and visual functions (Saftari & Kwon, 2018) ⁽¹³⁾. While other studies, divided the causes to

Extrinsic (environment-related), intrinsic (person-related), and behavioral (activity-related) factors are just a few of the multifaceted causes of falling⁽²¹⁾. The majority of screening programs to identify persons at risk of falling include an evaluation of gait and balance. Gait instability and losing of balance have been established as a relatively consistent risk factors for falls (Ganz, Bao, Shekelle & Rubenstein, 2007)⁽¹⁵⁾.

Determining the risk factors for falls and balance loss in older adults has been the focus of numerous studies. Impaired balance and gait, polypharmacy, and a history of previous falls have been identified as the main risk factors. Age, female gender, visual impairments, cognitive decline, particularly attention and executive dysfunction, and environmental factors are additional risk factors (Ambrose, Paul, & Hausdorff, 2013)⁽¹⁶⁾. Other studies emphasize that most of falls are associated with one or more known risk factors for falls such as weakness, unstable gait, confusion, and some drugs, and studies have shown that paying attention to these risk factors can considerably lower the likelihood of falls (Rubenstein, 2006)⁽¹⁷⁾.

2.1.3 Human Balance

2.1.3.1 Balance Systems

The Somatosensory /Proprioceptive System, Vestibular System, and Visual System are the systems that supply information regarding the body's equilibrium and maintain balance. However, the Central Nervous System receives information from these three primary sensory systems concerning the orientation of the body, integrates this information, and then produces a corrective, stabilizing torque by selectively activating muscles. Healthy participants typically use 60% vestibular information, 30% vision information, and 10% somatosensory information on firm surfaces, but this ratio changes to 70% somatosensory information, 20% vestibular information, and 10% vision information on unstable (Peterka, 2002)⁽¹⁸⁾.

2.1.3.1.1 Somatosensory System

Postural balance must be controlled by proprioceptive input from spinocerebellar pathways that is processed subconsciously in the cerebellum (Lions, Bui, Wiener-Vacher & Bucci, 2014)⁽¹⁹⁾. Monosynaptic pathways that can receive information as quickly as 40–50 milliseconds (ms) in proprioceptive input have the least time delays,

making it the main contributor to postural control under ordinary situations (Hwang, Agada, Kiemel & Jeka JJ ,2014)⁽²⁰⁾.

2.1.3.1.2 Vestibular System

As response to head motion, this system produces compensatory responses by postural responses (Vestibulo-Spinal Reflex) which work when the body is suddenly knocked off balance by keeping the body upright and preventing falls, while ocular-motor also known as vestibulo-ocular reflexes, enable the eyes to maintain a constant focus while the head is moving. Visceral reactions (Vestibulo-Colic Reflex) assist in keeping a neutral, steady, and erect posture for the head and neck on the shoulders. In order to do this, the vestibular system measures head rotation and head acceleration via otolith organs and semi-circular canals (utricle and saccule) (Hwang, Agada, Kiemel & Jeka JJ ,2014)⁽²⁰⁾.

2.1.3.1.3 Visual System

For non-impaired people, the contribution of the visual system to postural control is partially unnecessary under normal situations that's because the visual information has greater time delays of up to 150–200 ms (Hwang, Agada, Kiemel & Jeka JJ ,2014)⁽²⁰⁾. According to Friedrich et al research⁽¹⁴⁾, adults with visual problems can adapt peripheral, vestibular, somatosensory, and cerebellar processing to make up for their visual information deficit and to offer effective postural control (Friedrich et al. ,2008)⁽²¹⁾. Peterka also discovered that, in order to achieve efficient postural stability, persons with bilateral vestibular abnormalities can improve their visual and proprioceptive information even more than healthy elderly. The parameters of the visual environment and the support surface, such as the size and rigidity or compliance of the base of support, affect how shifting visual fields affect postural stability (Peterka, 2002)⁽¹⁸⁾.

2.1.3.2 Postural Control

The act of maintaining, obtaining, or restoring the line of gravity inside the BoS is known as postural control (Maki & McIlroy, 1996)⁽²²⁾. Even in healthy older people, aging-related alterations in the sensory and neuromuscular system have a negative impact on performance in static and dynamic postural control (Maki & McIlroy, 1996)⁽²²⁾. Cross-sectional studies show that healthy older individuals have higher center of pressure displacements (CoP) and sway velocity in bipedal and unipedal calm stances

under various conditions (such as eyes open/closed; stable/unstable surface), in comparison to young adults. Critical postural control indicators that have been linked to a higher risk of falling (Era,2006) ⁽²³⁾. However, it has been discovered that three major categories of human activity are linked to the control of balance (Pollock, Durward, Rowe & Paul, 2000) ⁽²⁴⁾. maintaining a particular stance, such as sitting or standing, Active motion, such as switching between postures (Pollock, Durward, Rowe & Paul, 2000) ⁽²⁴⁾ The response to an outside disturbance, such as a shove, trip, or slip. These categories cover actions that preserve, achieve, or reinstate the line of gravity inside the BoS (Pollock, Durward, Rowe & Paul, 2000) ⁽²⁴⁾.

2.1.3.2.1 Strategies of balance- postural control (Proactive, Reactive)

Strategies of Postural control may be either ‘**reactive**’ (compensatory) or ‘**proactive**’ (predictive/anticipatory), or a combination of both (Pollock, Durward, Rowe & Paul,2000)⁽²⁴⁾.A voluntary movement or an increase in muscle activity in preparation for a predicted disturbance could be part of a proactive predictive postural control strategy. On other hand, a reactive postural control strategy might involve movement or muscular response to an unanticipated disturbance. These responses can be "fixed-support," in which the base of support is altered but the line of gravity is left in place, or "change-in support," in which the base of support is moved so that the line of gravity intersects it (Pollock, Durward, Rowe & Paul, 2000) ⁽²⁴⁾.Swinging from the hip or ankle (also known as the "ankle strategy") While gripping with the hand or stepping (also known as the "stepping strategy") are frequently change-in-support techniques are frequently described as fixed-support strategies. It is now believed that postural responses to maintain balance depend on the evaluation and control of numerous variables by the central nervous system (CNS), contrary to the previous view that postural control methods are reflex-like reactions generated spontaneously by sensory stimulation (Pollock, Durward, Rowe & Paul, 2000) ⁽²⁴⁾. Therefore, postural control strategies differ depending on the objectives of an individual and the surrounding environment (Pollock, Durward, Rowe & Paul, 2000) ⁽²⁴⁾.

According to this theory of postural control, the CNS can be said to have learned the fundamental motor skill of balance control. Therefore, with practice and training, posture control techniques can improve in effectiveness and efficiency just like any other motor skill (Pollock, Durward, Rowe&Paul,2000) ⁽²⁴⁾.

Consequently, postural control can be considered as a complicated motor skill that is essential to human posture and movement (Pollock, Durward, Rowe & Paul, 2000)⁽²⁴⁾.

2.1.3.2.2 Static and Dynamic Balance

Balance can be categorized as follows: **Static balance** which is the capacity to keep the body in a particular fixed posture. Static balance is the capability to maintain postural stability and orientation while the body is at rest and the center of mass is above the base of support. While **Dynamic balance** is the capacity to move the vertical projection of the center of gravity around the supporting base of support. It is more difficult to define dynamic postural stability. Furthermore, the ability to maintain postural stability and orientation with the center of mass over the base of support while the body components are in motion is known as dynamic balance (Sullivan & Portnry, 2014)⁽²⁵⁾

2.1.3.2.3 Correlation between Static and Dynamic Balance

The correlation and variations between static and dynamic postural stability in healthy, physically active people were investigated in a study by Sell TC (2012). Using the Dynamic Postural Stability Index, a single-leg standing task was used to assess static postural stability, and a single-leg landing activity was used to assess dynamic postural stability. According to the author's analysis, there was no association between static and dynamic metrics. The increase in difficulty during dynamic measurements, however, indicates to variations in the kind and degree of effort presented by the different postural stability tasks (Sell, 2012)⁽²⁶⁾.

The difficulty placed on the systems required for maintaining postural stability is probably the cause of the absence of association between the two different situations. Establishing an equilibrium between destabilizing and stabilizing forces is necessary for maintaining postural stability in both dynamic and static situations, and this needs sensory data from the vestibular systems, vision, and somatosensory input (Sell, 2012)⁽²⁶⁾. According to Dunsky et al., 2017, there is a low association between static and dynamic balance for both women and men. this study was consisted from older adults n = 112, Age: 75, Study groups: 1. women n = 86, 2. men n = 36. the outcome measures that used in study included TUG, FR for dynamic balance assessments while for static balance assessments they used COP length of sway, COP sway intensities. (Dunsky, Zeev, Netz, 2017)⁽²⁷⁾.

2.2 Similar Studies

There are many studies that showed the effectiveness of general Balance training in improving function and decreasing falls rate among the elderly population. But, there were no studies that talked particularly about proactive balance.

In a systematic review and meta-analysis study published in 2015 which aimed to quantify Balance training intervention effects and to further characterize dose-response relationships of BT modalities (e.g., training period, training frequency) that could lead to maximum improvement in balance performance in healthy community-dwelling older adults through the analysis of 23 randomized controlled trials (RCTs). The main findings summarized as following:

Training Period: The results of the analysis showed that training for 11–12 weeks had the greatest impact on both overall balance performance (mean SMDbs = 1.26; 23 studies) and for more direct measurements of static steady-state balance (mean SMDbs = 1.54; 12 studies).

Training Frequency: The greatest improvements in both measures of overall balance performance (mean SMDbs = 1.20; 23 studies) and for more specific measures of static steady-state balance (mean SMDbs = 0.81; 12 studies) were seen with BT frequency of three sessions/week.

Training Volume (Number of Training Sessions During the Training Period): According to the results, a total of 36–40 training sessions is most successful in enhancing balance performance on a general level (mean SMDbs = 1.39; 23 studies); yet, it also performs well on more specific measures of static steady-state balance (mean SMDbs = 1.87; 12 studies).

Training Volume (Duration of a Single Training Session): The results showed that for more specific measurements of static steady-state balance (mean SMDbs = 1.64; 11 studies), as well as for overall balance performance (mean SMDbs = 1.19; 21 studies), a period of 31–45 minis was most effective.

Training Volume (Total Duration of Training Per Week): According to the results, a total of 91–120 minutes of BT per week is the most efficient for enhancing overall balance performance (mean SMDbs = 1.93; 21 trials). A total of 121–150 min (SMDbs

= 3.19; one study only) of BT per week had the greatest impact on enhancing indicators of static steady-state balance.

In conclusion, the study's analyses showed that a variety of BT modalities (training period, training frequency, and training volume, for example) contribute to improvements in measures of static/dynamic steady-state, proactive, and reactive balance as well as in the results of balance test batteries in healthy older adults. A successful BT protocol for healthy older individuals includes an 11–12-week training period, three training sessions per week, a total of 36–40 sessions, a single session's duration of 31–45 minutes, and a weekly training time of 91–120 minutes (Lesinski et al., 2015)⁽²⁸⁾.

According to study done by Thiamwong & Suwanno in 2014, to describe the results of participation in a 3-month simple home-based balancing training program on assessments of balance performances and fear of falling in Thai elderly adults. Both the functional reach test and the timed up-and-go test results for the exercise group's participants after 12 weeks of balance training were significantly different from baseline results. The functional reach test and timed up-and-go test results after 3, 6, 9 and 12 months showed that the exercise group performed significantly better than the control group. In the exercise group, the fear of falling also decreased after 3, 6, 9, and 12 months. (Thiamwong & Suwanno, 2014)⁽²⁹⁾.

According to systematic review that published by Sherrington et al. in 2019⁽³⁰⁾, which aimed to evaluate the effects of exercise interventions for preventing falls in older people living in the community. They found that exercise programs help elderly residents of the community fall less frequently and experience fewer falls overall. Exercise programs that reduce falls mainly focus on functional and balance exercises, Tai Chi may also reduce the risk of falling, although the impact of weight training (without balance and functional activities), dancing, or just walking is unknown.

Another study published by Sherrington et al. 2017⁽¹⁾, which was update of a systematic review with random effects meta-analysis and meta-regression for Previous meta-analyses have shown that older adults who exercise avoid falling. This study investigated whether elements of the trial design, sample, or intervention are related with stronger fall prevention effects and tested whether this impact is still present when new trials are added. In general, they found that exercise decreased the rate of falls

among older individuals living in communities by 21% (pooled rate ratio 0.79, 95% CI). But, Greater impacts were observed from exercise programs that challenged balance and included more than 3 hours of exercise per week ($p=0.001$, I² 47%, 69 comparisons, 0.73 to 0.85).

3. Chapter Three

Methodology

3.1 Introduction

3.2 Study Settings

3.3 Study Design

3.4 Study Sample & population

3.5 Data Collection

3.6 Study Procedures

3.7 Statistical Analysis

3.8 Ethical considerations

Chapter Three

3.1 Introduction

In this chapter, we described the study methodology. It organized as follow: study design, setting, sample size, and population size (method of sampling, inclusion, and exclusion criteria). Also, this chapter clarified the data collection procedure, study procedure, statistical analysis, and ethical considerations.

3.2 Study Setting

This study conducted at Golden Care Center which is Elderly Rehabilitation Center in Jaffa, Occupied Palestinian Territories 1948, where physiotherapy is one of the therapeutic interventions for each elderly person 5 personal sessions / week. It's a rehabilitation geriatric center that's a part of the Golden Care Network on the region, which consists from 5 floors include department for respiratory care (9 rooms with 22 beds), dementia care and complex nursing (22 rooms eith 45 beds), two rehabilitation departments (15 rooms in each one with 45 beds), each department include therapies rooms for physical therapy rehabilitation, occupational therapy, dietitian, communication technician, social working and meeting hall, doctors room and nursing station. It specialized in providing a comprehensive services to a target population in the third age ≥ 55 years (Golden Care,2019)⁽³³⁾

However, this rehabilitation center served as the focus of our study because it has a good representation of older people who have fall history. In addition, their rehabilitation treatment programs focus on balance training as a major element. Finally, It's our workplace and we want to assess the program's efficacy as it related to the patients it served.

3.3 Study Design

The researcher adopted the Prospective Cohort Design, which is going ahead in time from a certain time to follow the progress of two or more groups from exposure to outcome (Grimes & Schulz, 2002)⁽³⁵⁾. Also, known as a subset of observational studies in which the outcomes are monitored over time and assessed at one or more time points for a cohort of individuals who share particular characteristics in order to determine the incidence of a predetermined outcome following exposure to a certain factor, whether it be a risk factor, medication, or intervention (Wang & Kattan,2020)⁽³⁴⁾.

This design will be used to evaluate the effectiveness of the proactive balance training program that is usually conducted at the Golden Care Elderly Rehabilitation Center in Jaffa, Occupied Palestinian Territories 1948 for improving balance and preventing falling among elderly. The benefits of this approach include the opportunity to examine a range of outcomes that may be related to a certain type of exposure (Grimes & Schulz, 2002) ⁽³⁵⁾. Also, it can provide data of higher quality on the primary exposure and confounding factors (LaMorte, 2021) ⁽⁶¹⁾. Moreover, because exposures are assessed before outcomes are observed, they are less likely to be biased (LaMorte, 2021) ⁽⁶¹⁾.

3.4 Study Sample and Population

This section included the sampling strategy that we will be used in our research and explain why we will choose it, as well as the inclusion and exclusion criteria and sample size.

3.4.1 Sampling Method

In this study, the researcher used Convenient Sampling which is a non-probability sample method, this form of sampling aims to select the participants from the people who are available at the place of the study and at the time that we have (Taherdoost, 2016) ⁽³⁶⁾. This sampling type has advantages, were easy to do, quick, easy to select participant, inexpensive, and convenient (Taherdoost, 2016) ⁽³⁶⁾. This sampling technique will be used because it will be difficult to find potential participants of a specific age and then select a random sample for follow -up.

3.4.2 Sample size

The researcher recruited all the eligible patients who met the inclusion criteria between 01.02.2023 to 01.06.2023.

3.4.3 Inclusion Criteria

1. Patients \geq 65 years
2. Patients treated at the Golden Care Rehabilitation Center
3. Patients who are able to walk independently or with supervision
4. History of falls
5. With or without a walking aid
6. Willing to sign informed consent.

3.4.4 Exclusion Criteria

In this Study, we excluded patients who:

1. Did not walk independently
2. Are using a lower limb immobilization device.
3. Refused to sign the consent form
4. Had neurological diseases (such as Parkinson, Alzheimer's disease, etc..) or cognitive problems (were unable to follow instructions)

3.5 Data Collection

Data collected from patients who recruited them from Golden Care Rehabilitation Center which located in Jaffa, Occupied Palestinian Territories 1948.

3.5.1 Data collection tools

The main tools were Data Collection Sheet, Time Up & Go, The Berg Balance Scale ,10 Meter Walk Test, Fall Efficacy Scale- International, Functional Reaching Test.

3.5.1.1 Data collection Sheet:

This sheet aimed to collect information about the patient's gender, age, weight, height, BMI, Comorbidities, and the outcomes measures (pre / posttests).

3.5.1.2 Timed Up and Go test:

A standardized outcome measure called the TUG is used to evaluate older individuals' mobility (Podsiadlo & Richardson, 1991)⁽³⁷⁾. The timed "Up & Go" measures how long it takes someone to get up from a conventional armchair (approximate seat height: 46 cm), move three meters, turn around, and return to the chair before sitting down once more. The individual uses his usual walking aid (walker, cane, or none) and wears his regular shoes. Physical help is not provided. This test was run three times, and the average of the three runs (in seconds) was determined and used as the basis for the study (Bischoff. et al, 2003)⁽³⁸⁾. Older persons who live in the community should be able to complete the TUG in under 12 seconds (Bischoff. et al, 2003)⁽³⁸⁾. A TUG score of **13.5 seconds** or longer was found to be predictive of a falls risk, according to a 2014 systemic review of research publisher in BMC Geriatrics ⁽³⁹⁾. A TUG score under 13.5 seconds, however, indicates higher functional performance (Barry, Galvin, Keogh, Horgan & Fahey, 2014)⁽³⁹⁾.

The TUG has been demonstrated to have strong inter- and intra-rater reliability (Bischoff. et al, 2003) ⁽³⁸⁾. According to reports, the ICC is higher than 0.95 (Schoene et al, 2013) ⁽⁴⁰⁾. The sensitivity and specificity have been reported to be 87% (Shumway, Brauer & Woollacott, 2000) ⁽⁶⁰⁾. Better balance is indicated by lower values. The TUG is regarded as a measurement of dynamic balance as well as general mobility because it perfectly describes body transitions such as direction changes and changes in center of mass height (Shumway, Brauer & Woollacott, 2000) ⁽⁶⁰⁾.



Figure 0.1 Time up and Go Test

3.5.1.3 Ten-Meters Walk Test:

A performance measure used to evaluate walking speed in meters per second over a short distance (Academy of Neurological Physical Therapy, 2022) ⁽⁴³⁾. It used to assess functional mobility, gait, and vestibular function. Participants in the test are timed with stop watch while they walk for 10 meter in a clear pathway without assistance, Assistive devices may be used, but must be kept consistent and documented for each test. Start timing when the toes pass the 2-meter mark and stop timing when the toes pass the 8-metre mark to allow for acceleration and deceleration (Academy of Neurological Physical Therapy, 2022) ⁽⁴³⁾. Calculating Gait Speed: total distance/time. For example: if did a 10-meter gait speed test and it took 7 seconds, the equation would like: $10 \text{ meters} / 7 \text{ seconds} = 1.4 \text{ meters per second}$.

This test shows excellent test-retest reliability for comfortable gait speed ($r = 0.75 - 0.90$) (Watson, 2002) ⁽⁴⁴⁾, sensitivity of 87.5%, specificity of 86.2%

(Yoshimoto, Oyama, & Tanaka (2015) ⁽⁶²⁾). To assess the significance of a patient's 10MWT score, a comprehensive evaluation may be employed in conjunction with cut-off scores and normative values. **Cut-off Scores:** (Stroke) less than 0.4 m/s household ambulators, 0.4-0.8 m/s restricted community ambulators, >0.8 m/s community ambulatory (Perry, Garrett, Graney & Mulroy,1995) ⁽⁵⁸⁾. While for healthy older persons, a cutoff score of less than 0.7 m/s indicates a higher risk of adverse outcomes (fall, hospitalization, need a for caregiver, fracture, etc.) (Montero-Odasso. et al,2005) ⁽⁵⁹⁾.

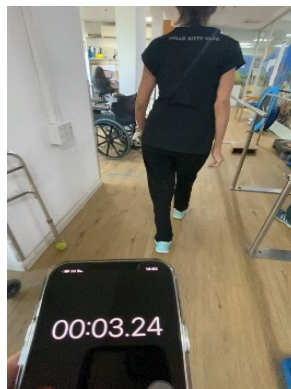
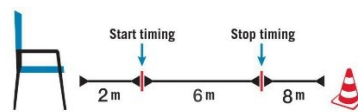


Figure 0.2 Ten meter Walk Test

3.5.1.4 The Berg Balance Scale:

The Berg Balance Scale is a test used to assess functional balance (Miranda, & Tiu,2022) ⁽⁴⁵⁾. It was developed to assess elderly people's capacity for balance (Miranda, & Tiu,2022) ⁽⁴⁵⁾. It assesses balance both dynamically and statically using 14 mobility-related tasks (Miranda, & Tiu,2022) ⁽⁴⁵⁾. The scale has shown helpful in estimating results, evaluating the probability of falls, and even determining how long patients should stay in inpatient rehabilitation (Miranda, & Tiu,2022) ⁽⁴⁵⁾. It is a quick test that may be completed in a variety of settings in a short period of time (Miranda, & Tiu,2022) ⁽⁴⁵⁾. The sensitivity of test is 0.72, while specificity is 0.73(Park & Lee, 2017) ⁽⁵⁵⁾. High intra-rater and interrater reliability has been demonstrated in studies of a variety of older

groups (N = 31–101, 60–90+ years of age; ICC =.98;14;15; Ratio of Subject Variability to Total =.96–1.0;16 rs =.8817) (Berg , Wood, Williams, 1995) ⁽⁵⁶⁾. Berg balance scale results are often interpreted as follows, according to Berg and his colleagues (Berg, Wood-Dauphinee, Williams & Maki,1992) ⁽⁵⁷⁾:

0 to 20: high fall risk, an individual with a score in this range probably needs a wheelchair to get around safely.

21 to 40: moderate fall risk, a person who falls within this group will require walking aids like a cane or walker.

41 and 56: low fall risk, a person with a score in this range is considered independent and should be able to go around safely without help.



Figure 0.3 The Berg Balance Scale

3.5.1.5 Functional Reaching Test:

Clinical outcome measure and assessment tool for assessing dynamic balance in one simple task (Duncan, Weiner, Chandler, & Studenski,1990) ⁽⁴⁷⁾. FRT was developed to predict fall risk in frail adults and elderly (Duncan, Weiner, Chandler, & Studenski,1990) ⁽⁴⁷⁾. Participants in the functional reach test stand unsupported next to a wall with their feet placed comfortably apart and their dominant arm lifted to 90 degrees of shoulder flexion. They were instructed to reach forward as far as they could without overbalancing. Overbalancing was defined as the requirement for a step, the need for hands-on support to keep one's balance, or the need to lean against a wall. The extended reach's length was reported (Duncan, Weiner, Chandler, & Studenski,1990) ⁽⁴⁷⁾. The reliability inter-rater agreement on reach measurement = 0.98 (Duncan, Studenski,

Chandler, & Prescott, 1992)⁽²⁰⁾. Eagle et al.⁽⁵³⁾ found out the following: Sensitivity = 76%, Accuracy = 46%, Specificity = 34%, Positive Predictive Value = 33%, Negative Predictive Value = 77%⁽⁵³⁾. the clinical cut of values as followed: 10 inch/25 cm or greater Low risk of falls; 6 inch/15cm to 10inch/25cm Risk of falling is 2x greater than normal; 6inch/15cm or less Risk of falling is 4x greater than normal; Unwilling to reach Risk of falling is 8x greater than normal (Duncan, Weiner, Chandler, & Studenski,1990)⁽⁴⁷⁾. The Age related norms for the functional reach test: Men Age Women (in inches) **20-40yrs:** (in inches) men 16.7 ± 1.9 – women 14.6 ± 2.2 , **41-69yrs:** men 14.9 ± 2.2 –women 13.8 ± 2.2 , **70-87yrs:** men 13.2 ± 1.6 – women 10.5 ± 3.5 (Duncan, Weiner, Chandler, & Studenski,1990)⁽⁴⁷⁾. A longer maximum safe standing forward reach is indicated by higher values. The test reformed twice. For data analysis, the score that was higher was used. (Duncan, Weiner, Chandler, & Studenski,1990)⁽⁴⁷⁾.

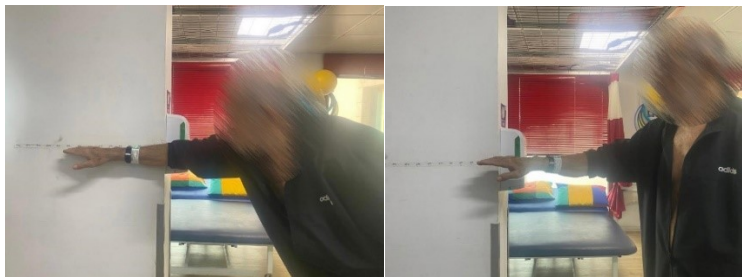


Figure 0.4 Functional Reaching Test

3. 5.1.6 Fall Efficacy Scale -International (FES-I)

The Falls Efficacy Scale International (FES-I) is a questionnaire that evaluates one's fear of falling (FOF). The definition of fear of falling is a constant worry of falling, which ultimately restricts how one goes about performing daily activities. The Prevention of Falls Network Europe group (ProFaNE) produced the 16-item Fall Efficacy Scale (FES-I), which included the social dimension of FOF, to the original 10-item FES. For the elderly population who live in the community, a 7-item version of the FES-I (short FES-I) has also been designed, validated, and advised. This will reduce the assessment load and improve acceptability (Yardley et al, 2005)⁽⁴⁸⁾.

Scoring and administration: Participants are asked to rate how concerned they are about the potential of falling while engaging in 16 activities on a four-point Likert scale. Regardless of whether they undertake the exercise, participants are instructed to rate it. For the FES-I and the short FES-I, the scores are totaled up to generate a total score that varies from 16 to 64 (Helbostad et al., 2010)⁽⁴⁹⁾. Total score ranged from 16 (no concern about falling) to 64 (severe concern about falling).

Reliability: The FES-I and short FES-I have high test-retest reliability (ICC = 0.96 and 0.83) and strong internal consistency (Cronbach's alpha = 0.96 and 0.92) among a group of people who live in communities. The 16 FES-I items have an average inter-item correlation of 0.55. (range 0.29 to 0.79) (Yardley et al., 2005)⁽⁴⁸⁾. **Validity:** In elderly people who are frail, the FES-I and short or original FES have a strong correlation ($r > 0.90$) (Hauer et al., 2011)⁽⁵⁰⁾. The FES-I has been shown to have convergent construct validity for the following: prior falls; depressive symptoms; total disability; poor quality of life; and physical impairment (Hauer et al., 2011)⁽⁵⁰⁾. Additionally, both the FES-I and short FES-predictive validity (during a one-year follow-up) demonstrate that both tests may reliably predict future falls, physiological fall risk, muscular weakness, overall impairment, and depressive symptoms (Delbaere et al., 2010)⁽⁵¹⁾. **A cut-point for high FOF** has been established by Delbaere et al as scores > 23 for the 16-item scale and scores > 10 for the 7-item scale (Delbaere et al., 2010)⁽⁵¹⁾.

3. 6 Study Procedures

The proposal was discussed at the level of the higher committee of the MPT program at the physiotherapy department at Al-Quds University. The ethical clearance was requested from Al-Quds University Ethical Committee. After that permission was granted from the managers of rehabilitation center, then each patient who fitted the inclusion criteria was invited to participate. After that, the purpose of the study was explained. then, those who freely decided to participate requested to sign a written informed consent. After signing the consent form and obtaining their acceptance, a Data collection sheet was filed, and the outcome measures and clinical tests were applied at baseline and then later at follow-up after 8 weeks (with no interference at the nature or the intensity of programs). Then after data was collected, statistical analysis took place

to highlight the effect of the proactive balance training program that was given in the rehabilitation center.

3.6.1 Regular Daily given Program by the institution

The center's regularly scheduled daily program intervention, which is conducted over the entire rehabilitation period (8 weeks), is as follows: 5 training sessions per week, 300 minutes of training volume (the total amount of time spent exercising each week), and 60 minutes of training volume every training session, which includes: **Proactive Balance Intensive Training** for 60 minutes/ session (total duration of training per week – 300 minutes). Each session began with a quick (5-7 minutes) warm-up that included arm and neck motions, marching in place, standing on one leg, shifting weight, and lunges. This was followed by 15 minutes of exercises done while sitting on balls and another 15 to 20 minutes of exercises done while standing and walking. Short breathing exercises and stretching were done at the end of each session. To add diversity, the sitting, standing, and walking exercises varied from session to session. However, each activity made a comeback later in the program, frequently in a more challenging format. For examples of workouts and additional motor and cognitive demands (multi-task activities). The program included different balance exercises with different difficulty levels including Base of support: stable to unstable (starting from normal gait to narrow gait to tandem gait), position of feet (i.e., medial or lateral, weight shift, on heels or toes), surface (from stable to unstable), Dual / Multi-tasking (Additional motor and cognitive tasks), Speed of movement (Decrease or increase of execution speed like walking speed), Equipment: using ball, Thera -Band, free weights, balance foam pad, balance cushion, blazpod), Directions (Forward, backward, to left or right, diagonal), Rhythm (Slow, intermittent (slow /fast), Fast) . In progress, combine the balance tasks with activities of daily living (e.g. walking backward with closed eyes, upstairs backward, walking while preventing the tennis ball in the racket from falling into the ground). Strengthening exercises for 10 minutes (focusing on quadriceps, core muscles, and calf muscles). Important to mention that the session mostly consisted of eight balance exercises as mentioned above depending on the target of a session (10–20 repetitions for each around 60 sec and then 30 sec break), which took about 60 min/ day. The target and intensity of training were individually set. Depending on improvement, both the duration and frequency of the exercises increased gradually. The focus was primarily on tasks that were getting more complicated and challenging. There

was little chance that participants were unbalanced and fell throughout the test or intervention since those tasks are challenging to balance control. To guarantee patient safety while performing these tasks, appropriate safety measures are used. In addition, only certified and qualified physiotherapists provided the interventions. The principal researcher completed the outcome measures at baseline and discharge.

3.7 Statistical Analysis

Data captured using SPSS software 23, Demographic data presented by descriptive statistics. Balance outcome measures and FES-I at baseline and after 8 weeks for the group analyzed by paired t-test/Wilcoxon. Correlation person and Spearman tests detected a correlation between different factors and outcome measures. A P-value of ≤ 0.05 is considered statistically significant. Multivariate regression model analysis investigated predictors of better balance among group.

3.8 Ethical Considerations

Ethical clearance granted by the Research Ethics Committee in Al-Quds University. Permission was also granted by the rehabilitation center's manager. In addition, every patient who met the inclusion criteria and agreed to enter the study was invited to sign a consent form, which included that they expressed their full understanding of the research objectives, procedures, and risks. Important to mention that the consent form was written in Arabic language to be understood easily by all participants. All participants acknowledged their right to withdraw from the study at any stage without being obliged for any explanations. They confirmed that all the data will be used for scientific reasons only. Every person who filled the data collection sheet or conducted the tests knew that all information was handled confidentially, as no names were used in the analysis or presentation of results and the researcher took full responsibility for protecting the right of privacy of the participants. In addition, they knew that the results that we found, would be available for dissemination to AL-Quads University, and worldwide through the publication of the results.

4. Chapter Four

Results presentation, Analysis & Discussion

4.1 Results Presentation and Analysis

4.2 Results Discussion

Chapter Four

4.1 Results Presentation and Analysis

4.1.1 Recruitment and Follow-up Process:

At Baseline, forty-two patients were recruited and tested (pre-tests) from Golden Care Rehabilitation Center in Jaffa, the same number of participants were followed up and tested after 8 weeks (post-tests), with no loss of any patients of participants during the study.

4.1.2 Descriptive of Demographics:

The study sample were 42 patients, each one was treated by the regular balance training composed of a proactive balance training program.

4.1.2.1. Age of participants

As presented in table 4.1 the average age of participants was 79.2 ± 6.96 years (mean \pm SD).

Table 0.1 Age Group Percent

	N	Min	Max	M	SD
Age	42	66	93	79.24	6.959

4.1.2.2. Age Group

As shown in Figure 4.1, **81%** of the participants were over 70 years old.

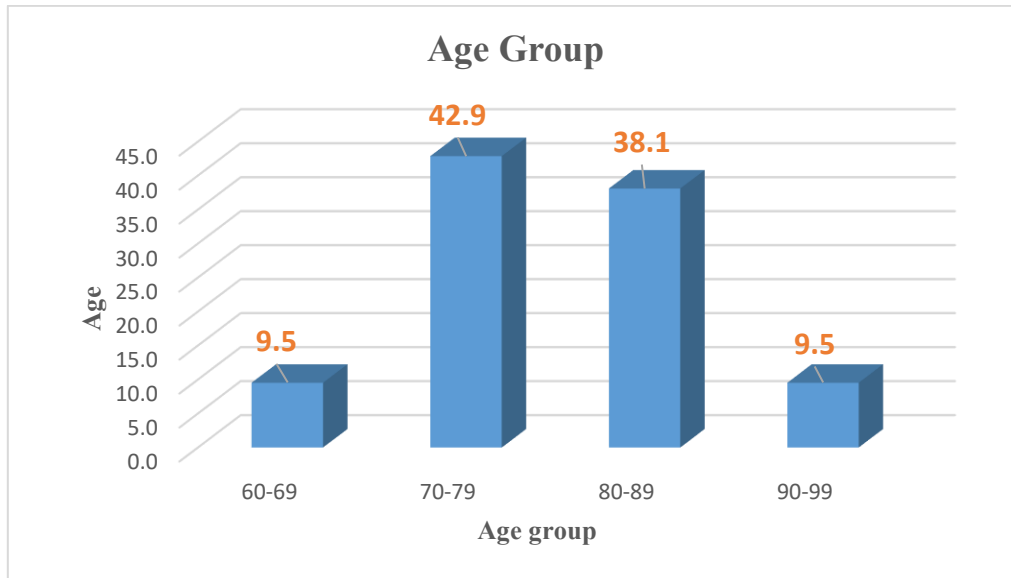


Figure 0.1 Age Group Percent

4.1.2.3. Gender of participants

As seen in Figure 4.2, males composed **55%** of the sample. The sample group included (23) Males and (19) Females.

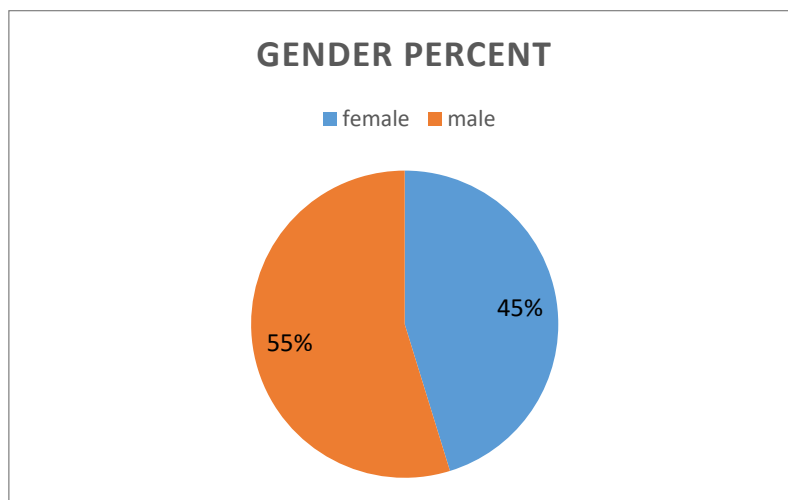


Figure 0.2 Gender of participants

4.1.2.4. Co-morbidities

As shown in Figure 4.3, **83.3%** of the participants had HTN, **61.9 %** DM while **16.7%** of them had cancer.

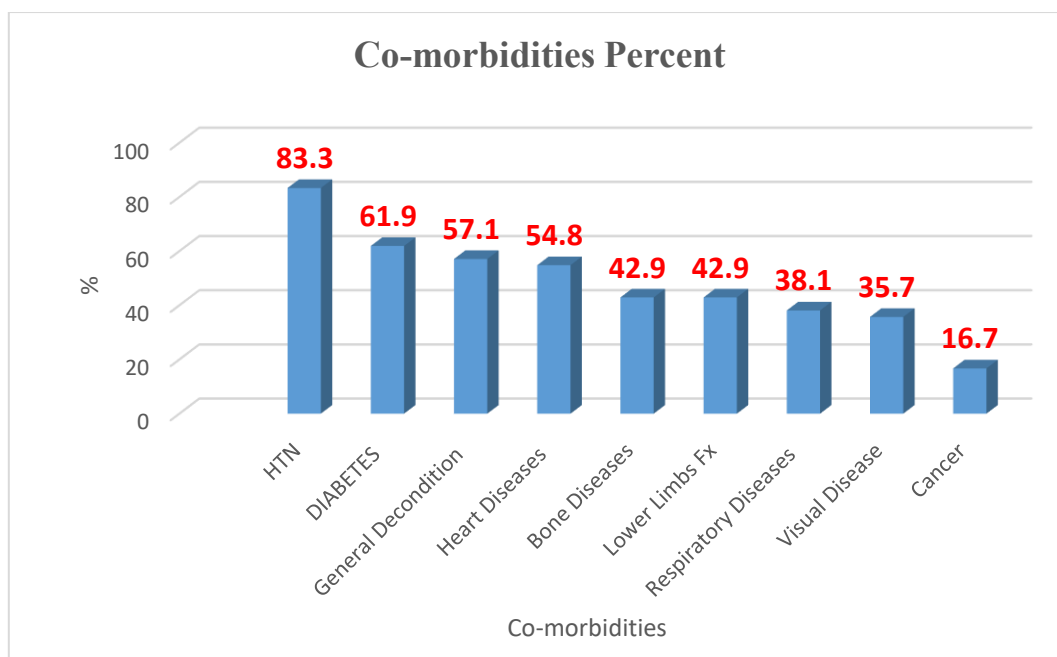


Figure 0.3 Most Co-morbidities b/w participants

4.1.2.5. BMI

As we can see in Table 4.2 below, the average BMI of participants was 24.96 kg/m².

Table 0.2 BMI of participants

	N	Min	Max	M(Kg/m ²)	SD
BMI	42	17	37	24.96	4.433

4.1.2.6. BMI Categories

As shown in Figure 4.4, Most of the participants are under “**overweight**” category **42.9 %**, while **35.7%** are categorized under “**healthy weight** “and **9.5%** of them under “**Obesity**”.

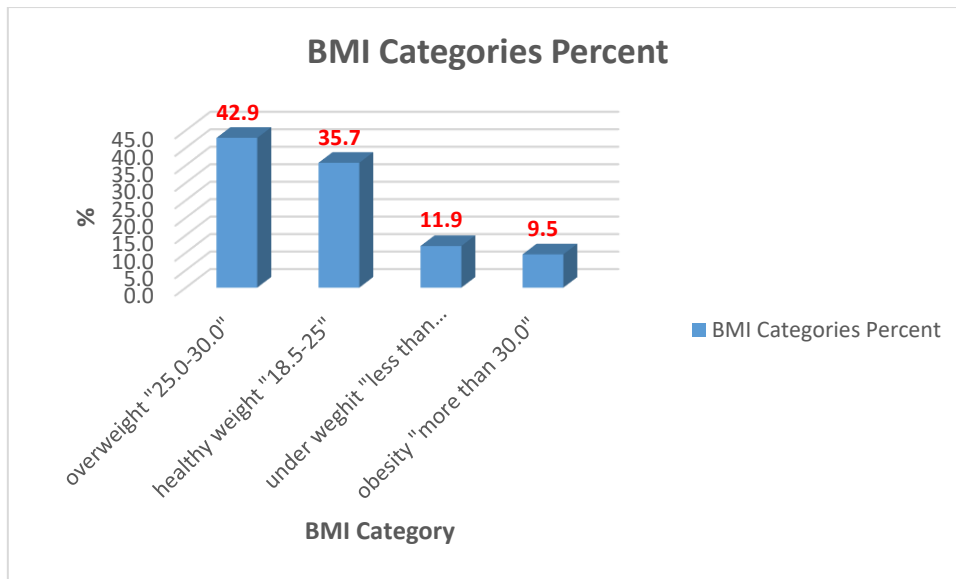


Figure 0.4 BMI Categories of the participants

4.1.2.7. Assistive devices

As seen in Figure 4.5, Most of the participants used walker (57.1%).

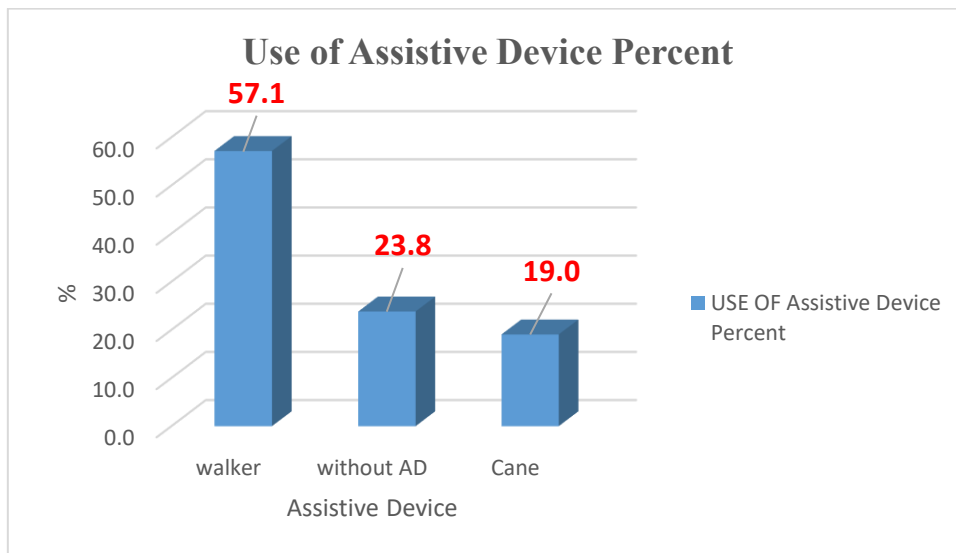


Figure 0.5 Use of Assistive Device

4.1.3 Normality test:

Normality of study variables was conducted before starting the analysis to decide the use of parametric if $p > 0.05$ or non-parametric if $p < 0.05$ statistical tests. The tests of Kolmogorov-Smirnov and Shapiro- Wilk were used for this purpose, and the following (Table 4.3) shows the results of this test:

Table 0.3 Normality Test:

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Improvement in TUG	.175	42	.002	.921	42	.007
Improvement in 10MWT	.118	42	.159	.942	42	.033
Improvement in FRT	.158	42	.010	.913	42	.004
improvement in Berg Balance Scale	.140	42	.039	.943	42	.037
Improvement in Fall Efficacy Scale	.207	42	.000	.887	42	.001
*. This is a lower bound of the true significance.						
a. Lilliefors Significance Correction						

4.1.4 Inferential statistical analysis

4.1.4.1. Testing for Factors may effect on the outcome measures improvement:

4.1.4.1.1. Anthropometric Variables:

Testing for correlation between mean improvement of outcome measures (10MWT, FRT, FES, BBS, TUG) with weight, Height, BMI. There was no statistically significant association between any of variables above mentioned with any of the outcome measures which mentioned above ($P > 0.05$). As presented below in [Table 4.4](#).

Table 0.4 the correlation between Anthropometric Variables and the improvement of outcome measures:

		TUG Improve ment	10MWT Improve ment	FRT Improve ment	BBS Improve ment	FES Improve ment
Wei ght	Pearso n Correl ation	.200	.051	-.005	.029	-.071
	Sig. (2- tailed)	.203	.750	.974	.855	.656
	N	42	42	42	42	42
Hei ght	Pearso n Correl ation	.284	.274	.021	-.189	.180
	Sig. (2- tailed)	.062	.079	.896	.230	.253
	N	42	42	42	42	42
BM I	Pearso n Correl ation	.007	-.103	-.013	.147	-.168
	Sig. (2- tailed)	.966	.517	.936	.354	.286
	N	42	42	42	42	42

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

4.1.4.1.2. Gender

As presented in Table 4.5 below, testing for the difference of improvement according to gender, there was no statistically significant difference in mean improvement of outcome measures based on gender ($p > 0.05$).

Table 0.5 The mean difference of outcome measures improvement according gender:

	Gender	N	Mean	Std. Deviation	Std. Error Mean	Sig (2 tailed) /Independent sample test
Improvement in FRT	male	23	23.48	9.61	2.00	0.051
	female	19	18.68	5.56	1.28	
Improvement in 10MWT	male	23	.60	.23	.049	0.212
	female	19	.52	.177	.04	
Improvement in TUG	male	23	- 17.20	8.49	1.77	0.297
	female	19	- 20.07	9.06	2.08	
Improvement in FES	male	23	- 55.83	26.04	5.43	0.571
	female	19	- 51.26	25.55	5.86	
Improvement in BBS	male	23	21.60	10.14	2.11	0.869
	female	19	21.10	9.40	2.18	

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.1.4.1.3. Co-morbidities

As shown in Tables (4.6, 4.7, 4.8, 4.9, 4.10, 4.11, 4.12, 4.13, 4.14, 4.15, 4.16) below, testing for the difference of improvement according to co-morbidities, there was no statistically significant difference in mean of outcome measures improvement based on any of the co-morbidities (General Deconditioning, HTN, DM, Heart Diseases, Lower Limb fractures, Respiratory Diseases, Cancer, Vision problems, Bone diseases, Hyperlipidemia, Smoking ($p > 0.05$)).

General Deconditioning

Table 0.6 the difference of improvement according of General Deconditioning:

If patient has General Deconditioning		N	Mean	Std. Deviation	Std. Error Mean	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	24	.59	.23	.05	1.19	0.24
	No	18	.5200	.19	.04		
Improvement TUG	yes	24		-18.26	9.09	-0.38	0.703
	No	18		-18.81	8.54		
Improvement FRT	yes	24		21.08	8.33	-0.21	0.82
	No	18		21.61	8.48		
Improvement BBS	yes	24		22.37	9.36	-0.91	0.36
	No	18		20.05	10.24		
Improvement FES	yes	24		-60.25	24.70	-0.66	0.55
	No	18		-45.11	24.84		

HTN

Table 0.7 the difference of improvement according of HTN:

If patient has HTN		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	35	0.53	0.19	-1.63	0.15
	No	7	0.71	0.27		
Improvement TUG	yes	35	-18.21	10.18	-0.08	0.93
	No	7	-18.84	6.91		
Improvement FRT	yes	35	22.47	9.19	-0.68	0.5
	No	7	19.89	7.05		
Improvement BBS	yes	35	22.78	10.89	-0.15	0.88
	No	7	19.68	7.97		
Improvement FES	yes	35	-52.39	27.84	-0.76	0.45
	No	7	-55.42	23.26		

DM

Table 0.8 the difference of improvement according of DM :

If patient has Diabetes Mellitus		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	26	0.56	0.19	-0.22	0.83
	No	16	0.57	0.25		
Improvement TUG	yes	23	-18.06	8.91	-0.45	0.65
	No	19	-19.21	8.74		
Improvement FRT	yes	23	23.50	8.61	-2.48	0.01
	No	19	17.75	6.53		
Improvement BBS	yes	23	21.69	10.32	-0.19	0.85
	No	19	20.87	8.89		
Improvement FES	yes	23	-52.50	25.95	-0.34	0.74
	No	19	-55.81	25.73		

Heart Diseases

Table 0.9 the difference of improvement according of Heart Diseases :

If patient has Heart Disease		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	23	0.59	0.23	0.74	0.46
	No	19	0.54	0.18		
Improvement TUG	yes	23	-18.21	10.18	-0.9	0.37
	No	19	-18.84	6.91		
Improvement FRT	yes	23	22.47	9.19	-0.83	0.41
	No	19	19.89	7.05		
Improvement BBS	yes	23	22.78	10.89	-0.78	0.43
	No	19	19.68	7.97		
Improvement FES	yes	23	52.39	27.84	-0.27	0.79
	No	19	55.42	23.26		

Lower Limb Fractures

Table 0.10 the difference of improvement according of Lower Limb Fractures:

If patient has Lower limb Fractures		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	18	0.50	0.19	-1.53	0.13
	No	24	0.60	0.22		
Improvement TUG	yes	23	-18.57	7.96	-0.38	0.7
	No	19	-18.44	9.48		
Improvement FRT	yes	23	21.27	8.25	-0.22	0.83
	No	19	21.33	8.51		
Improvement BBS	yes	23	19.27	8.64	-0.92	0.36
	No	19	22.95	10.31		
Improvement FES	yes	23	-45.22	24.99	-0.76	0.45
	No	19	-60.16	24.64		

Respiratory Diseases

Table 0.11 the difference of improvement according of Respiratory Diseases:

if patient has Respiratory Disease		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	16	0.57	0.25	1.19	0.24
	No	26	0.56	0.19		
improvement TUG	yes	16	-21.41	11.27	-0.87	0.39
	No	26	-16.70	6.39		
Improvement FRT	yes	16	23.12	7.07	-1.5	0.13
	No	26	20.19	8.91		
Improvement BBS	yes	16	24.87	10.99	-1.43	0.15
	No	26	19.23	8.31		
improvement FES	yes	16	-60.56	24.81	-1.374	0.17
	No	26	-49.57	25.65		

Cancer

Table 0.12 the difference of improvement according of Cancer:

if patient has Cancer		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	Yes	7	0.69	0.30	1.35	0.22
	No	35	0.54	0.18		
Improvement TUG	yes	7	-19.14	6.22	-0.62	0.53
	No	35	-18.37	9.25		
Improvement FRT	yes	7	20.57	4.39	-0.32	0.75
	No	35	21.45	8.91		
Improvement BBS	yes	7	20.85	10.27	-0.15	0.88
	No	35	21.48	9.73		
Improvement FES	yes	7	-56.42	24.90	-0.07	0.95
	No	35	-53.22	26.06		

Vision Problems

Table 0.13 the difference of improvement according of Vision Problems:

if patient has visual problems		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	15	0.53	0.19	-0.9	0.38
	No	27	0.59	0.22		
Improvement TUG	yes	15	-19.11	9.24	-0.34	0.73
	No	27	-18.15	8.64		
Improvement FRT	yes	15	24.26	8.97	-1.65	0.1
	No	27	19.66	7.58		
Improvement BBS	yes	15	20.93	9.91	-0.18	0.85
	No	27	21.62	9.75		
Improvement FES	yes	15	-61.86	22.48	-1.52	0.13
	No	27	-49.25	26.51		

Bone Diseases

Table 0.14 the difference of improvement according of Bone Diseases:

if patient has bone disease RA, OP, OA		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	Yes	18	0.50	0.15	-1.81	0.08
	No	24	0.61	0.23		
Improvement TUG	yes	18	-20.01	9.07	-1.16	0.25
	No	24	-17.36	8.53		
Improvement FRT	yes	18	22.94	9.08	-1.01	0.31
	No	24	20.08	7.62		
Improvement BBS	yes	18	21.16	11.02	-0.33	0.74
	No	24	21.54	8.82		
Improvement FES	yes	18	-65.61	19.71	-2.45	0.01
	No	24	-44.87	26.25		

Hyperlipidemia

Table 0.15 the difference of improvement according of Hyperlipidemia:

if patient has hyperlipidaemia		N	Mean	SD	t-test / Mann Whitney	Sig (2-tailed)
Improvement 10MWT	yes	10	0.51	0.21	-0.78	0.44
	no	32	0.58	0.21		
Improvement TUG	yes	10	-20.01	9.07	-0.43	0.67
	No	32	-17.36	8.53		
improvement FRT	yes	10	22.94	9.08	-0.76	0.45
	No	32	20.08	7.62		
Improvement BBS	yes	10	21.16	11.02	-0.98	0.33
	No	32	21.54	8.82		
Improvement FES	yes	10	-65.61	19.71	-1.58	0.11
	No	32	-44.87	26.25		

Smoking

Table 0.16 the difference of improvement according of Smoking:

if patient smoker		N	Mean	SD	t-test / Mann Whitney	Sig (2- tailed)
Improvement 10MWT	yes	8	0.65	0.24	1.401	0.17
	No	34	0.54	0.20		
Improvement TUG	yes	18	-20.59	11.14	-0.79	0.43
	No	24	-18.00	8.22		
Improvement FRT	yes	18	21.00	7.52	-0.18	0.86
	No	24	21.38	8.57		
Improvement BBS	yes	18	24.62	11.56	-0.75	0.45
	No	24	20.61	9.23		
Improvement FES	yes	18	-62.12	25.82	-1.19	0.24
	No	24	-51.79	25.54		

4.1.4.2. Time up and Go Test:

4.1.4.2.1. Difference in mean for TUG improvement between baseline and follow up:
As shown in Figure 4.6, there was an improvement in TUG between pre-test and post-test around **18.51 seconds**.

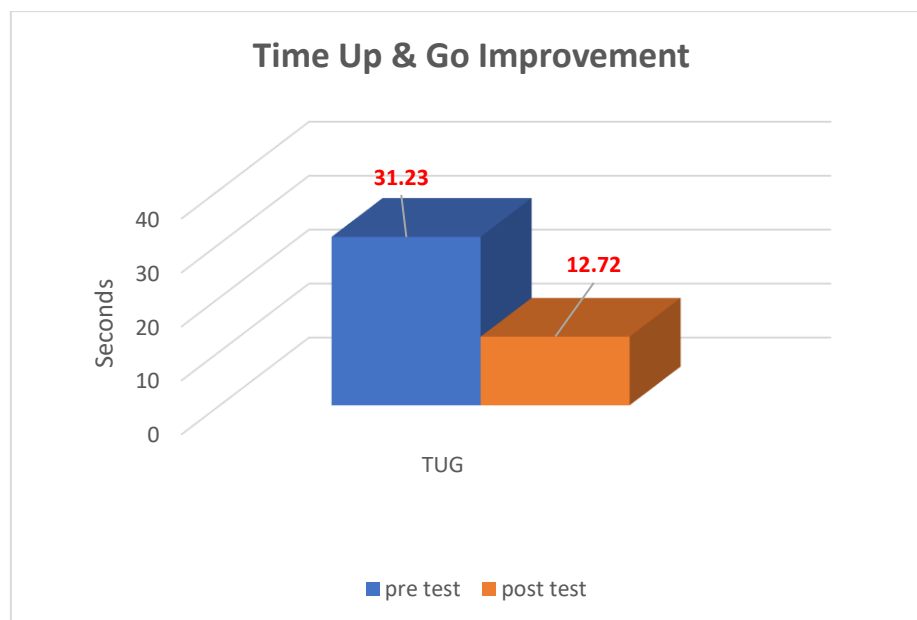


Figure 0.6 Time up & GO improvement

Table 4.17 below, showed the mean and standard deviation for pre-test and post test of Time up and Go test. It demonstrated that there was statistically significant improvement between pre- test and post- test ($p < 0.01$).

Table 0.17 TUG improvement between baseline and follow up:

Test	pre-test (M)	SD	post-test (M)	SD	t-test/Wilcoxon	sig(2 tailed)
TUG	31.23	10.14	12.72	3.96	-5.65	0.000

4.1.4.2.2. Predictors of TUG Improvement:

As presented below in Tables (4.18,4.19, 4.20) the multivariate analysis showed a model that predicts **88.5%** of the variation of the TUG improvement in subjects between baseline and follow-up ($P < 0.05$). the main predictors were Pretest TUG at baseline ($B = -0.859$) and age ($B = 0.252$).

Table 0.18 Model Summary for Predictors of TUG improvement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
2	.941 ^b	.885	.879	3.04296

a. Predictors: (Constant), Pre-test TUG

b. Predictors: (Constant), Pre-test TUG, Age

c. Dependent Variable: Improvement in TUG

Table 0.19 ANOVA for predictors of TUG improvement

Model	Sum of Squares	df	Mean Square	F	Sig.
2 Regression	2786.722	2	1393.361	150.477	.000 ^c
Residual	361.125	39	9.260		
Total	3147.846	41			

a. Dependent Variable: Improvement in TUG

b. Predictors: (Constant), Pre-test TUG

c. Predictors: (Constant), Pre-test TUG, Age

Table 0.20 Coefficients for the predictors of TUG improvement

Coefficients ^a								
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations		
	B	Std. Error				Beta	Zero-order	Partial
2 (Constant)	-11.641	5.456		-2.134	.039			
Pre-test TUG	-.859	.050	-.994	-17.106	.000	.922	-.939	-.928
Age	.252	.073	.200	3.444	.001	.157	.483	.187

a. Dependent Variable: Improvement in TUG

4.1.4.3. Ten-Meter Walk Test:

4.1.4.3.1. Difference on mean for 10MWT improvement between baseline and follow up:

Figure 4.7 illustrates the improvement in 10MWT between pre- and post-test, which was about **0.56 m/sec**.

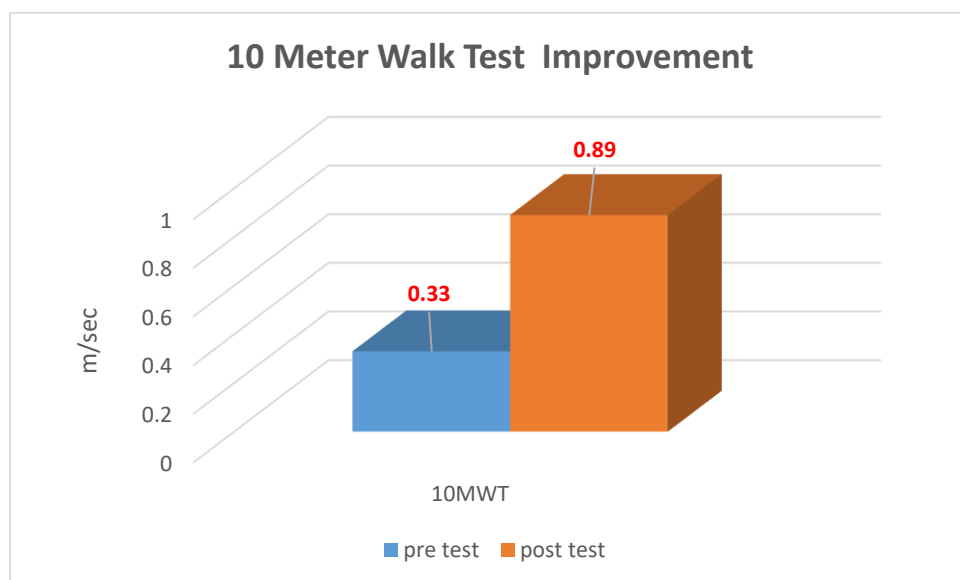


Figure 0.7 Ten Meter Walk Test Improvement

There was statistically significant improvement between the pre- and post-tests, as shown in table 4.8 (P< 0.01).

Table 0.21 Ten meter walk test improvement between baseline and follow-up

Test	pre-test (M)	SD	post-test(M)	SD	t- test/ Wilcoxon	sig(2 tailed)
10MWT	0.33	0.09	0.89	0.22	-17.33	0.000

4.1.4.4. Berg Balance Scale:

4.1.4.4.1. Difference on mean for Berg Balance Scale Improvement at baseline and follow up:

As shown in [Figure 4.8](#), there was an improvement in BBS between pretest and posttest around 21.38 points.

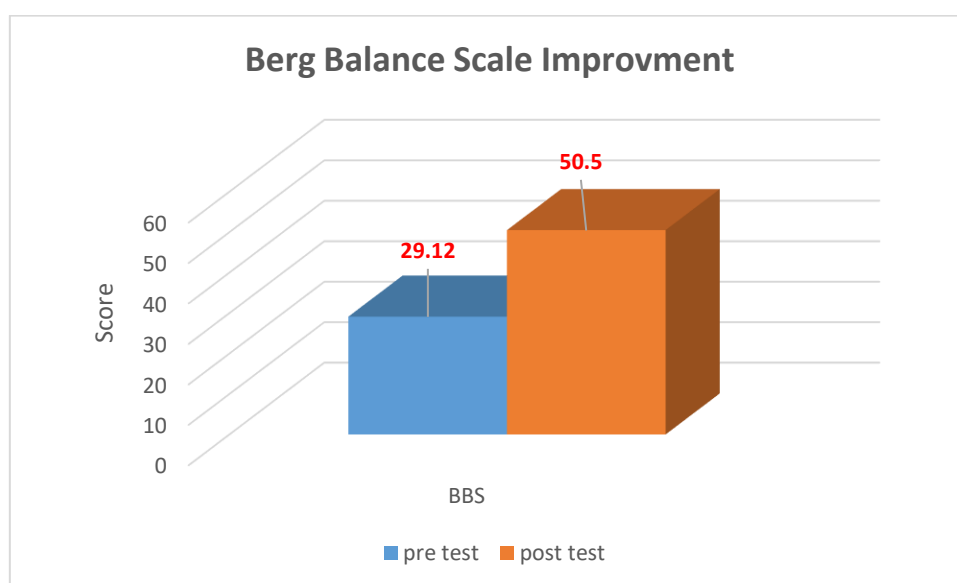


Figure 0.8 Berg Balance Scale Improvement

There was statistically significant improvement between the pre and post tests, as shown in [Table 4. 22](#) ($P < 0.01$).

Table 0.22 BBS improvement between Baseline and follow -up

Test	pre-test(M)	SD	post-test(M)	SD	t- test/ Wilcoxon	sig(2 tailed)
BBS	29.12	10.61	50.50	4.45	-5.65	0.000

4.1.4.4.2. Predictors of BBS Improvement:

The multivariate analysis finds a model that predicts **83.7%** of the variation in the BBS improvement in patients between baseline and follow up ($P < 0.05$), as shown in Tables (4.23,4.24, 4.25) below. Pre-test BBS at baseline (**B= -0.925**) and age (**B= -0.243**) were the primary predictors.

Table 0.23 Model Summary for predictors of BBS improvement

Model Summary ^c									
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	df 2	Sig. F Change
2	.915 _b	.837	.829	4.01214	.026	6.165	1	39	.017

a. Predictors: (Constant), Pre-test Berg Balance Scale

b. Predictors: (Constant), Pre-test Berg Balance Scale , Age

c. Dependent Variable: improvement in Berg Balance Scale

Table 0.24 ANOVA for BBS improvement's predictors

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
2	Regression	3228.110	2	1614.055	100.269	.000 ^c
	Residual	627.795	39	16.097		
	Total	3855.905	41			

a. Dependent Variable: improvement in Berg Balance Scale

b. Predictors: (Constant), Pre-test Berg Balance Scale

c. Predictors: (Constant), Pre-test Berg Balance Scale, Age

Table 4.25 Coefficients BBS improvement's predictors

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
2 (Constant)	67.569	8.730		7.740	.000
Pre-test Berg Balance Scale	-.925	.067	-.969	-13.799	.000
Age	-.243	.098	-.174	-2.483	.017

a. Dependent Variable: improvement in Berg Balance Scale

4.1.4.5. Functional Reaching Test:

4.1.4.5.1. Difference on mean for FRT Improvement between baseline and follow up: Figure 4.9 illustrates the improvement in FRT between the baseline and post tests, which was about **21.31 cm**.

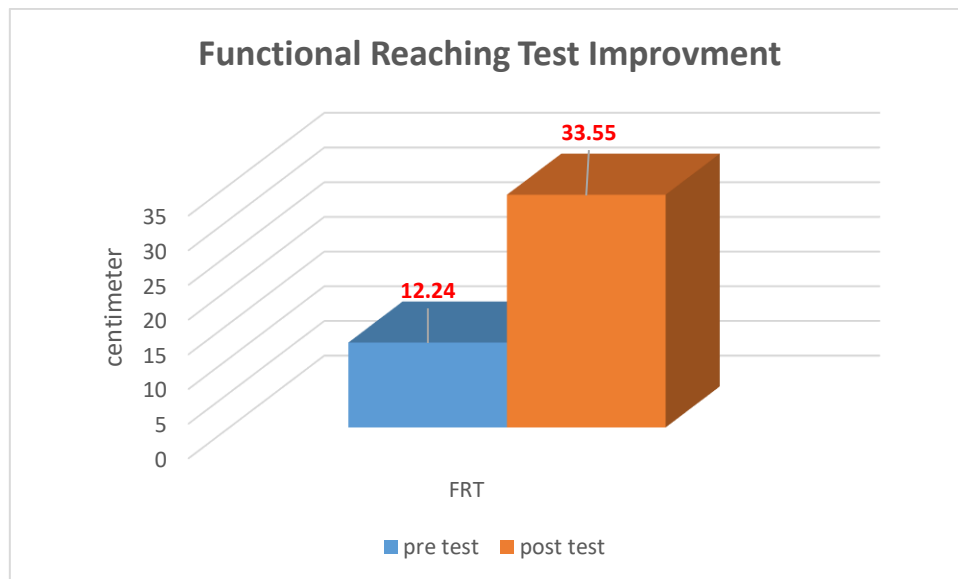


Figure 0.9 Functional Reaching Test Improvement

There was statistically significant improvement between the pre and post tests, as shown in Table 4.26 ($P < 0.01$).

Table 0.26 Functional Reaching Test Improvement between baseline and follow –up :

Test	pre-test(M)	SD	post-test(M)	std.dev2	t-test/Wilcoxon	sig(2 tailed)
FRT	12.24	6.49	33.55	8.1	-5.65	0.000

4.1.4.5.2. Predictors of FRT Improvement:

According to Tables (4.27,4.28,4.29) below, the multivariate analysis identifies a model that predicts **45.6%** of the variation in the FRT improvement in patients between baseline and follow-up ($P < 0.05$). The main predictors were Gender (**B= -4.795**), Pretest FES (**B= 0.263**) and pre-test BBS at baseline (**B= -0.239**).

Table 0.27 Model Summary of predictors of FRT improvement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
3	.675 ^c	.456	.413	6.35986	.074	5.172	1	38	.029

- Predictors: (Constant), Pre-test Fall Efficacy Scale
- Predictors: (Constant), Pre-test Fall Efficacy Scale, Sex
- Predictors: (Constant), Pre-test Fall Efficacy Scale, Sex, Pre-test Berg Balance Scale
- Dependent Variable: Improvement in FRT

Table 0.28 ANOVA for FRT improvement's predictors

Model	Sum of Squares	df	Mean Square	F	Sig.
3 Regression	1287.960	3	429.320	10.614	.000 ^d
Residual	1537.016	38	40.448		
Total	2824.976	41			

- Dependent Variable: Improvement in FRT
- Predictors: (Constant), Pre-test Fall Efficacy Scale
- Predictors: (Constant), Pre-test Fall Efficacy Scale, Sex
- Predictors: (Constant), Pre-test Fall Efficacy Scale, Sex, Pre-test Berg Balance Scale

Table 0.29 Coefficients of FRT improvement's predictors

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
3 (Constant)	14.202	8.603		1.651	.107			
Pre-test Fall Efficacy Scale	.263	.078	.438	3.398	.002	.554	.483	.407
Sex	-4.795	1.977	-.291	-2.425	.020	-.291	-.366	-.290
Pre-test Berg Balance Scale	-.239	.105	-.293	-2.274	.029	-.439	-.346	-.272

a. Dependent Variable: Improvement in FRT

4.1.4.6. Fall Efficacy Scale:

4.1.4.6.1. Difference on mean for Fall Efficacy scale improvement at baseline and follow-up:

FES improved by about 53.76 points between the pre- and post-test, as seen in Figure 4.10 below.

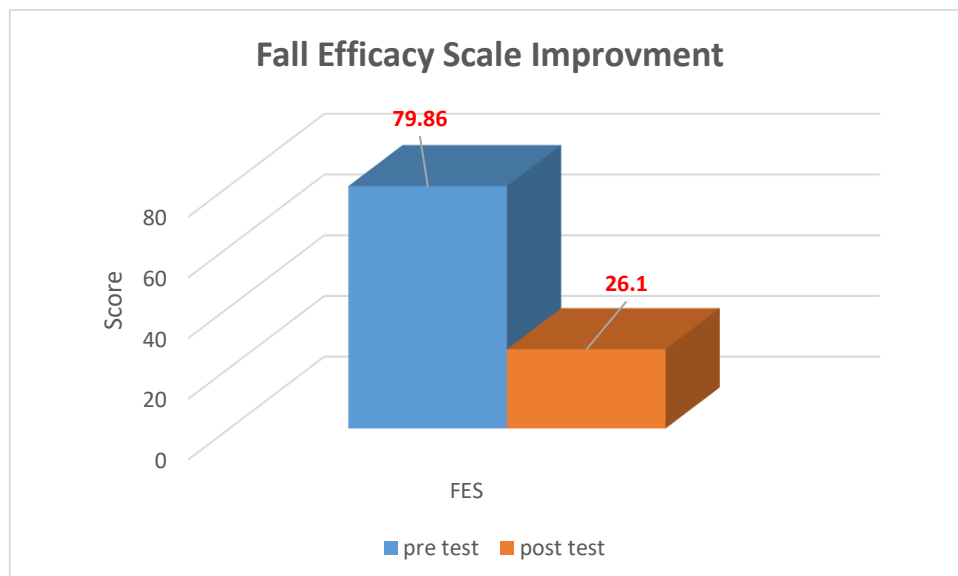


Figure 0.10 Fall Efficacy Scale Improvement

According to Table 4.30 below, the improvement between the pre- and post-tests was statistically significant ($P < 0.01$).

Table 0.30 FES improvement between baseline and follow -up

Test	Pre-test	SD	Post-test	std.dev2	t-test/Wilcoxon	sig(2 tailed)
FES	79.86	13.79	26.1	18.13	-5.65	0.000

4.1.4.6.2. Predictors of Fall Efficacy Scale:

The multivariate analysis identifies a model that predicts **61.6%** of the variation in the FES improvement in patients between baseline and follow-up ($P < 0.05$), as shown in table (4.13,4.14,4.15) below. The significant predictors were Age (**B= 1.037**), Pretest FES (**B= -1.358**). According to Tables (4.31,4.32 ,4.33) below.

Table 0.31 Model Summary for Predictors of FES improvement

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
2	.785 _b	.616	.596	16.27456	.079	8.061	1	39	.007

- a. Predictors: (Constant), Pre-test Fall Efficacy Scale
- b. Predictors: (Constant), Pre-test Fall Efficacy Scale, Age
- c. Dependent Variable: Improvement in Fall Efficacy Scale

Table 0.32 ANOVA for FES improvement's predictors

Model	Sum of Squares	df	Mean Square	F	Sig.
2 Regression	16558.033	2	8279.016	31.258	.000 ^c
Residual	10329.586	39	264.861		
Total	26887.619	41			

- a. Dependent Variable: Improvement in Fall Efficacy Scale
- b. Predictors: (Constant), Pre-test Fall Efficacy Scale
- c. Predictors: (Constant), Pre-test Fall Efficacy Scale, Age

Table 0.33 Coefficients of FES improvement's predictors

Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig.	Correlations		
	B	Std. Error	Beta			Zero-order	Partial	Part
2 (Constant)	-27.514	32.643		-.843	.404			
Pre-test Fall Efficacy Scale	-1.358	.184	-.731	-7.363	.000	-.732	-.763	-.731
Age	1.037	.365	.282	2.839	.007	.286	.414	.282

a. Dependent Variable: Improvement in Fall Efficacy Scale

4.1.4.7. Correlation between the outcome measures:

As seen in Table 4.34 below, there is a significant negative correlation between TUG and FRT, TUG and 10MWT, TUG and BBS, FRT, and FES, and between FES and BBS ($P \leq 0.01$). As well as, a positive significant correlation between TUG and FES, and between FRT and BBS ($P < 0.05$). While, there was no significant correlation between 10MWT and BBS ($P > 0.05$) as well as 10MWT and FES ($P > 0.05$), 10MWT and FRT ($P > 0.05$).

Table 0.34 Correlation between the outcome measures:

		TUG Improvement	10MWT Improvement	FRT Improvement	BBS improvement	FES Improvement
TUG Improvement	Pearson Correlation	1	-.526**	-.391*	-.703**	.326*
	Sig. (2-tailed)		.000	.011	.000	.035
	N	42	42	42	42	42
10MWT Improvement	Pearson Correlation	-.526**	1	-.177	.139	.114
	Sig. (2-tailed)	.000		.263	.378	.471
	N	42	42	42	42	42
FRT Improvement	Pearson Correlation	-.391*	-.177	1	.554**	-.456**
	Sig. (2-tailed)	.011	.263		.000	.002
	N	42	42	42	42	42

BBS improvement	Pearson Correlation	-.703**	.139	.554**	1	-.430**
	Sig. (2- tailed)	.000	.378	.000		.004
	N	42	42	42	42	42
FES Improvement	Pearson Correlation	.326*	.114	-.456**	-.430**	1
	Sig. (2- tailed)	.035	.471	.002	.004	
	N	42	42	42	42	42

** . Correlation is significant at the 0.01 level (2-tailed).

* . Correlation is significant at the 0.05 level (2-tailed).

4.2 Results Discussion

The average age was 79.2 ± 6.96 (mean \pm SD) years, as shown in Table 4.1. Which was relatively considered a high age of the elderly, with expected further challenges in vision and proprioception which might be reflected in decreased balance abilities. This result was higher than the findings of Thiamwong et al. ⁽²⁹⁾ who found the average age on their study was 71.3 years while Sherregton et al., found the average age was 76 years in their study (Sherregton et al., 2019) (Thiamwonget al. ,2014) ⁽²⁹⁾ (Sherregton et al.,2019) ⁽³⁰⁾. This high age imposed different expectations of the different outcome measures results and also implied the additional need for further safety procedures when working with those patients.

Furthermore, the sample was almost 50% older than 80 years, indicating that longevity was rising overall, as Andrew noted in his study, which referred to this period as the health transition (Andrew, 2021) ⁽⁶³⁾.

Males were 55% of participants as demonstrated in Figure 4.2. This could not be indicating any elderly prevalence of balance challenges, but rather a reflection of the distribution of gender in this particular elderly care setting.

As for Co-morbidities prevalence, according to Figure 4.3, the most prevalent comorbidities were hypertension (reported by 83.3%), followed, in descending order by diabetes (61.9%), and general Deconditioning (57.1%), heart diseases (54.8%).

This result was consistent with the findings of the study conducted by Gerda and his colleagues in North Carolina, America, on the same age sample, the most common medical disorders were hypertension (57%) diabetes (20%), and heart disease (15%) (Fillenbaum et al.,2000)⁽⁶⁶⁾. Additionally, this outcome supported the findings of Saleim and his colleagues in Saudi Arabia who showed that hypertension and diabetes mellitus were the two most prevalent chronic diseases in the same age range, with a prevalence of 58.1%, and 48.6% respectively (Alsuwaidan et al., 2021b)⁽⁶⁷⁾. We noticed that in most of the studies, diabetes was the most prevalent comorbidity, which implied a potential loss of sensation that might affect balance as it was one of the major systems of balance composed of vision, sensory input, and vestibular.

As for the average of BMI, as shown in Table 4.2, was $24.96 \pm 4.43 \text{ Kg/m}^2$ (mean \pm SD). This result was consistent with Anna Hafstrom and her colleagues' findings who found that BMI was 24.5 Kg/m^2 in the study that aimed to assess the efficacy of a multimodal balance-enhancing exercise program for the elderly for the same age group that we included on our study (Hafström et al., 2016)⁽⁶⁵⁾.

Furthermore, as shown in Figure 4.4, most of the participants 45.9% were the "overweight" category and then "Healthy weight" category around 35% which came inline with the findings of Lee et al. which found that 50.7% of the sample of elderly was under "overweight" category and 47% of it was under healthy weight category (lee et al., 2019)⁷⁹. And that's mostly because the majority of elderly live sedentary lives and are inactive. So, Public institutions must therefore pay special attention to this group and provide them with appropriate daily activities, such as an integrated daily program that encourages them to lead active, healthy lives.

There was no difference in improvement of outcome measures based on Anthropometric variables (height , weight, BMI), gender, nor the existence of any of the co-morbidities, as in order for any of the comorbidities to affect balance, for example with diabetes it has to be in a very severe level, where it affects vision, and neural input from sensory nerves serving proprioception, which may not be the case in our sample, where they may have diabetes, but still not in the level of giving major effect on the deterioration of balance, and this result came in line with the findings of Walley et al. who found that The compensatory parallel sensory input from the vestibular and visual systems maintains balance even in the presence of peripheral

neuropathy among patients with diabetes mellitus (Walley et al., 2014)⁸⁴. And for the other co-morbidities, they might not very directly be associated with any of the balance input or output systems. This result highlighted the effectiveness of the intervention through the adopted proactive program that was given.

One of the important results of the study was that TUG improved between the pre-test and post-test by about 18.51 seconds and this difference was statistically significant, as indicated in Figure 4.6. This result reflected the improvement in functional mobility, which came in line with the findings of Bloch who found that the TUG improvement between baseline and follow-up among elderly with the same age group was 21 seconds (Bloch et al., 2017)⁽⁷⁸⁾.

Another finding of the study was that the main predictors of TUG improvement were age and pre-test TUG as presented in Table 4.20, since pretest TUG was a baseline, it represented the severity of balance dysfunction at baseline and the inverse relationship between TUG at baseline and TUG improvement might be justified by the fact that those who had longer (in seconds) TUG at baseline (less balance) regardless of age, had less or slow improvement, which means for example, patient who took 20 seconds to achieve Pre TUG will have slower or less improvement in TUG compared to who start with 12sec. which could be rephrased as an inverse relationship between balance dysfunction severity and improvement of balance at follow-up which was matching with the findings of Leirós and his colleagues who found the longer time took to finish the TUG test, the lower their physical ability improvement (Leirós-Rodríguez & García-Soidán, 2014)⁽⁷³⁾. It's worth mentioning that a severe balance was an outcome of dysfunction of balance systems represented in sensory input, vestibular, and vision. According to Judge et al., elderly persons' balance was impaired by decreased visual or foot/ankle proprioceptive input (Judge et al., 1995)⁽⁷⁰⁾. And in this study with an average age of 79, it was not surprising that those systems might be affected by both age and diabetes which was shown to be prevalent among 61.9%. which diabetes is well known to affect both vision and sensation (D'Silva et al., 2016)⁽⁶⁸⁾. So, an intervention of balance with such patients with severe balance dysfunction might be affected both those facts of aging and diabetes which in turn might justify the less improvement of balance in those patients. The association between the severity of diabetes and its possible association with less balance was not within the scope of this study, which left space for future research in this field. This also implied the importance of safety procedures

while training balance in this category of patients. Those results were consistent with the findings of Badke et al. who found that the more severe balance dysfunction is, the less improvement that could be achieved with balance rehabilitation (Badke et al., 2004)⁽⁷⁴⁾.

Age was positively associated with TUG improvement in this study, usually the balance is a combination of the input system represented above (vestibular, proprioception, and vision), but also it is an outcome of the combination of the input and the output system, (enough ROM and sufficient muscle power to react to the perceived balance) and both ROM and muscle strength might be affected with aging and sedentary lifestyle (inactivity) the program its self-incorporates those two dimensions which its expected optimum improvement might be reflected in the improvement in balance, and with more age those two systems might be more vulnerable for weakness and decrease in their efficiency, which highlighted the importance of balance exercises combined with ROM and strength for such patients. These findings came inline with the results of Marques et al. in 2017 who showed that an increase in muscle strength (especially Knee extension and flexion ROM and strength) lead to an increase in the elderly's capacity for static and dynamic balance (Marques et al., 2017)⁽⁷¹⁾.

These findings were important since studies have shown that impaired mobility increases dependency risk in daily living activities by an average of three to five (Frank, 2003)⁽⁸¹⁾. This is not surprising since the importance of mobility in daily activities like going to the market, the doctor, the cinema, or even across the street. Higher dependency may result in institutionalization and a worse quality of life. A good balance is considered to be essential for improving mobility and reducing the risk of falls (Frank, 2003)⁽⁸¹⁾.

Ten Meter walk test was improved between the pre-test and post-test by about 0.56m/s from 0.33m/s to 0.89m/s and this difference was statistically significant, as indicated in Figure 4.7. and this indicating a healthy aging walking speed mean. this result came inline with findings of Palmgren et al. who found that after applied balance training for 3 months for elderly patients, their walking speed was significantly improved ($P < 0.05$) (Palmgren et al., 2019)⁽⁸³⁾.

Furthermore, one more finding of our research indicated that the BBS improved by about 21.38 points between the pre-test and post-test, as seen in Figure 4.8. This result

supported with Anna's findings who reported that after a balance-enhancing exercise program showed a significant improvement in BBS $P \leq 0.018$ during follow-up (Hafström et al., 2016)⁶⁵.

The primary predictors of BBS improvement were the age and pre-BBS test as presented in Table 4.25. since pre-BBS is a baseline, it represents the severity of balance dysfunction during a series of predetermined tasks at baseline, and the opposite relationship between BBS at baseline and BBS improvement may be defensible by the fact that those who had lower pre-BBS at baseline (less balance), had more improvement, which could be rearticulated as an inverse relationship between balance dysfunction severity and improvement of balance at follow-up. For example, patient who started with pre BBS with 20/56 and post BBS was 45/56, his improvement will be 25 points compared with who started pre BBS 50/56 and ended with 56/56, his improvement will be 6 points. Despite the second one achieved full score of scale but when comparing the improvement, we found that the first one achieved more improvement even he did not have normal balance. And that may be due to the status of the patient at the baseline (may one after surgery and another after deconditioning), the comorbidities, the balance training program that is which designed individually depending in the patient needs. And this results confirms with findings of El-Kashlan et al, who found that patient with sever vestibular and balance dysfunction showed improvement in balance rehabilitation even the balance score was still below the normal (El Kashlan et al., 1998)⁷⁵. And as notice the result obtained above is the exact opposite of this. Here, it was found that those showed less improvement, they had a high pre-BBS at baseline. This explains the disparities between the two tests, as TUG depends on the number of seconds required to complete a task without any challenges, whereas BBS relies on greater abilities, such as 360-degree turning, and a longer time during single support. So, this demonstrates that those who faced larger challenges at baseline and overcame them, have stronger balance. And as a result, their improvement is less since they already belong to more advanced stages of balance. Despite the fact that the severity in the two tests were inverse with improvement. But a high score in the BBS test showed strong balance, while a lengthy duration or a high score in the TUG test indicated poor balance.

Age and BBS improvement were inversely correlated, thus as people get older, they make less progress. This result opposed what we found with the TUG test, which found

that improvement increases with age. This discrepancy could be attributed to the different nature of the two tests, as one measures how quickly a person can stand from a chair and cover a distance of three meters then curved trajectory and return to the chair to sit. While, BBS depends on the accomplishment of specific tasks that are highly challenging for the elderly due to a change in the three parts of balance (vision, vestibular, and sensory input) with aging (Osoba et al.,2019)⁽⁷²⁾. Those results came in line with the findings of Bloem and his colleagues who clarified that when the elderly are performing secondary work at the same time, balance is typically upset. This meant when their attention is divided between tasks, older adults find it difficult to maintain balance during activities (Bloem et al., 2001)⁽⁶⁹⁾. This is because the examination tasks require consistency of the balance system parts that we mentioned previously which deteriorates with age, despite chronic illnesses that make it worse. These results are supported with the findings of Osoba et al., who confirm that adults who are older also have a harder time keeping their balance while adapting to new sensory input. Even if adaption takes more time, it eventually ends up (it takes longer time to adapt but in the end adaptation becomes). Unlike young adults, they have more trouble than they do quickly reintegrating new sensory information for balance control and exhibit higher postural instability with the introduction of new sensory information (Osoba et al.,2019)⁽⁷²⁾.

Moreover, this research showed another finding that the improvement in FRT between the baseline and post-tests, which was approximately 21.31 cm, as shown in Figure 4.9. This result was in contrast with the findings of Kuptniratsaikul et al. who found that balance skills were improved in the frequent falls group except functional reaching test which was not statistically significant between groups in a study aimed to assess the effectiveness of a simple balancing training program in elderly patients with a history of frequent falls (Kuptniratsaikul ,2011) ⁽⁸²⁾.

Pretest FES, gender, and pretest BBS were the main predictors of FRT improvement as presented in Table 4.29. Since Pretest FES at baseline, which measures fall fear (16 no concerns, 64 strong concerns), demonstrated a positive correlation with improvement in FRT, it follows that those with high Pretest FES scores will also experience significant FRT improvement. It makes sense because patients who scored highly on the pre-FES questionnaire indicated that their high fear of falling, and they most likely had a sever balance dysfunction, which allowed them to give low score in FRT at the

baseline . And with training program they will gain confidence and improved balance so they will improved in FRT .

While there was an inverse relationship between FRT improvement and gender (mean (SD), male = 23.5 (9.61) cm, female = 18.7 (5.56 cm)), which meant that females showed less improvement in FRT compared to males, this may be due to the differences in output system, which consisted of muscle strength, range of motion, and bone density, which are considered by nature stronger in men, which let them have more balance during the test. These results came in line with the findings of Bohannon and his colleagues, who found that elderly men improved in FRT by 29.3 (7.5) cm more than females by 26.1 (6.5) cm (Bohannon et al., 2017)⁽⁷⁶⁾.

As for Pre BBS as a predictor for FRT improvement, it had an inverse correlation with FRT improvement. This may be explained by the fact that those with high pre-BBS will show less improvement in FRT, which is an aspect of the Berg balance scale. For instance, the patient had a baseline score of 50/56 with a reaching score of 4/4 and in pre-FRT had 30cm, which meant a good score in pre-FRT, and a post-BBS score of 56/56 and in Post, FRT has 35cm, which means he improved by 6 points in BBS and 5cm in FRT. In contrast, the patient who had low pre-BBS readings of 20/56 and 1/4 on the reaching component and had 15cm in pre-FRT at baseline, reflecting low pre-FRT at baseline, and post-BBS readings of 28/56 and achieved 4/4 in reaching section from BBS and post FRT was 30cm. He will have an improvement of 15cm in FRT. Therefore, this will suggest a good improvement in FRT. Although the first one received a high pre-BBS score, there are no serious balance issues that need to be improved because he already had functional reaching and nothing to improve on this part. So, after comparing the improvements, we found that the patient had a low pre-BBS score but had made greater progress even though he still did not have a high balance.

Additionally, another result of study indicated that FES improved by about 53.76 points between the pre-and post-test, as seen in Figure 4.10 below. This result was consistent with the findings of Kuptniratsaikul et al. who found that FES was improved significantly among the elderly in their study which aimed to assess the effectiveness of a simple balancing training program in elderly patients with history of frequent falls (Kuptniratsaikul ,2011) ⁽⁸²⁾.

Age and pre-FES were the key predictors of FES progress as shown in Table 4.33. Since pre-FES is a baseline, it reflects the level of fear of falling at baseline, and the inverse relationship between FES at baseline and FES improvement may be clarified by the fact that those with less balance (high FES scores at baseline), had more improvement in FES. This may be due to two reasons. Firstly, improving physically. For instance, patients who have had total hip replacement surgery will have a high pain threshold, a decline in strength, and sensory impairment. Secondly, psychologically, which could refer to the patient being in shock after a fall. Therefore, at baseline, they will give a low score because there are numerous factors that contribute to having poor balance, and via rehabilitation and the program that focuses on improving proactive balance to prevent falling, the patient's confidence will grow over the rehabilitation process and build confidence for movement. These results were consistent with the findings of Belloni who found that fall efficacy scores, for the same age group, at baseline predicted better gait and functional rehabilitation results for the elderly patients (Belloni et al., 2021)⁽⁷⁷⁾. Based on these findings, we suggested future research into the relationship between falling risk factors and fall efficacy as well as the effects of programming intended to address these concerns.

Regarding age, it had a positive correlation with improvement in FES, which means older elderly, have more improvement in FES. And we could justify that by the older elderly will show more fears and concerns at the beginning of rehabilitation, in addition to the potential association between age and more weakness, decreased ROM, and sensory changes that may affect balance which in turn will increase the falling fear among this age category, which by turn may justify this positive relationship, where patients showed less fear after that have had proactive balance intervention program, that targets all the above mentioned potential dysfunctions. So, they may give high scores depending on their fears and pain, and through improving, they regain their confidence and balance.

This study looked into the relationships between the outcome measures themselves, as shown in Table 4.34. There was a significant correlation between TUG and 10MWT. This result aligns with the findings of Sundström et al., who found that TUG performance is associated with and highly correlated with 10MWT performance in their study, which aimed to describe the outcome measure timed up and go and compare it with 10MWT (Sundström et al., 2022)⁽⁹¹⁾. Additionally, there was a significant negative

correlation between TUG and FRT ($P \leq 0.01$), and this supports the findings of Lee and Kim, who found that there is a negative statistical correlation between TUG and FRT, (LEE & Kim, 2017)⁹⁰ while Bennier et al., found that there is a positive significant correlation between TUG and FRT ($r = 0.56$, $P = 0.04$) (Bennie et al., 2003)⁸⁷. Furthermore, we found that TUG significantly negative correlated with BBS ($P < 0.01$). This result supports Bennie et al.'s findings, who found a significant negative correlation between these two outcome measures ($r = -0.47$, $P = 0.04$) in their study, which was designed to compare TUG and FRT with BBS (Bennie et al., 2003)⁸⁷. Also, there was a significant positive correlation between TUG and FES ($P < 0.05$). This result came in line with the findings of Figueiredo & Santos, who found that TUG correlated significantly with FES ($P < 0.01$) (Figueiredo & Santos, 2017)⁸⁸. It was consistent with further findings by Lee and Kim, who found that there is a moderate positive correlation with TUG in their study, which aimed to discover the correlation between the fear of falling and fall risk assessment tools in the community-dwelling frail elderly in Korea (Lee & Kim, 2017)⁹⁰.

As seen in Table 4.34, this study discovered the relationship between 10MWT and other outcome measures. We found that there was no significant correlation between 10MWT and FRT ($P > 0.05$). This result was opposed to Lee and Kim's findings which discovered that these two outcome measures were significantly correlated ($P < 0.05$) (Lee & Kim, 2017)⁹⁰. Also, we found no significant correlation between 10MWT and BBS ($P = 0.3$). And this result run counter to the findings of Lee and her colleagues in their study that looked into the discovered relationship between balance, GAIT, and activities of daily living in older adults with dementia, which found that there is a significant moderate negative association between BBS and 10MWT ($r = 0.710$, $P = .000$) and that is likely due to the sample size and the target population (N. G. Lee et al., 2020)⁸⁹. Additionally, this study discovered no significant correlation between 10MWT and FES, which is opposite to the findings of Lee and Kim, who found a negative correlation between these two outcome measures (Lee & Kim, 2017)⁹⁰. and these results may be due to the differences in the inclusion criteria. Their study excluded people who walk with an assistive device, with any vision or sensory problems, or with any pain that may affect walking, all of these were in our inclusion criteria. Also, we found that there was a moderately positive correlation between 10MWT and TUG, as we mentioned before ($r = 0.526$, $P = .000$).

This study showed that FRT has a correlation with other outcome measures, as indicated in Table 4.34. FRT and TUG have a statistically negative significant correlation ($P < 0.05$), as mentioned before. no significant correlation between 10MWT and FRT ($P > 0.05$). Additionally, there is a moderately significant correlation between FRT and BBS ($P < 0.01$), and these results come in line with those of Karuka et al., who showed that there was a positive and moderate correlation between the FRT and BBS ($r = 0.4845$, $p = 0.0067$) (Karuka et al., 2011)⁽⁸⁶⁾. While, Bennie et al. found in their study that the correlation between FRT and BBS was not significant, most likely due to the small sample size ($n = 20$), (Bennie et al., 2003)⁽⁸⁷⁾. Furthermore, we found that there is a significant negative correlation between FRT and FES ($r = -.456$, $P < 0.05$), and this result contrasts with the findings of Lee and Kim, who found that the Fall Efficacy Scale has no significant correlation with FRT ($p > 0.05$) (Lee & Kim, 2017)⁽⁹⁰⁾. While this study showed that there was no significant correlation between FRT and 10MWT, as mentioned before.

Additionally, to BBS's correlations with other outcome measures that mentioned before, we found that there is a significant negative correlation between BBS and FES ($r = -.703$, $P = .000$), and this comes in line with the findings of Lee and Kim, who found that there is a moderate negative linear correlation with BBS ($r = -0.412$) ($p < 0.05$) (Lee & Kim, 2017)⁽⁹⁰⁾, as seen in Table 4.34.

4.3 Study Limitations

There were several limitations to the present study which were as follows:

1. A control group was absent. We only compared pre- and post-intervention, having a control group was not possible with the policy of the rehabilitation center, where the study was conducted, and taking control from other institution was a risk for homogeneity of the interventions and may elicit lots of other confounding factors as difference of setting.
2. Because our goal was to research the effectiveness of proactive balance exercises in preventing falling among the elderly, we did not recruit non-fallers.

3. The scarcity of similar studies in literature review about proactive balance training, made it difficult to compare results with other studies.

4.3 Study Strengths

There were strengths for the present study which were as follows:

1. This study is considered the first to specifically focus on identifying proactive balance training and how it affects elderly.
2. The study recruited all the eligible populations who were in study setting and met the inclusion criteria without any loss for participants during study period.

5. Chapter Five

Conclusion & Recommendations

5.1 Conclusion

5.2 Recommendations

Chapter Five

5.1 Conclusion

1. The present study adopted a prospective cohort design and recruited 42 elderly patients (23 males and 19 females) from the Golden Care Rehabilitation Center in Jaffa, the study aimed to evaluate the effectiveness of a proactive balance training program in preventing falling among the elderly.
2. Tools of data collection used consisted of Data Collection Sheet, Time Up & Go (TUG), The Berg Balance Scale (BBS), 10 Meter Walk Test (10MWT), Fall Efficacy Scale-International (FES-I), and Functional Reaching Test (FRT) were used to compare all balancing abilities before beginning the rehabilitation program (pre-tests) and after 8 weeks (post-tests).
3. The present study accepted the alternative hypothesis and proved that there was statistically positive directed effect for Proactive balance training program in improving balance control and confidence in the elderly, which lead to improved functional mobility and self-efficacy in preventing falls, lowering fear of falling, increasing walking speed, and enhancing physical function.
4. The study found that there were no association between outcome measures improvement with Specific factors including gender, prevalence of comorbidities, neither association with any of the anthropometric variables. Which is highlighted the effectiveness of the proactive balance training that was given during rehabilitation period.
5. TUG significantly improved between the pre-test and post-test. The main predictors of TUG improvement were age and pre-test TUG. Furthermore, the BBS statistically improved between the pre-test and post-test, And the primary predictors of BBS improvement were age and the pre-BBS test. Moreover, our research showed another finding: the improvement in FRT between the baseline and post-tests. Pre-test FES, gender, and pre-test BBS were the main predictors of FRT

improvement. Additionally, FES improved significantly between the pre- and post-test. The key predictors of FES progress were age and pre-FES.

5.2 Recommendations

1. To enhance the use of balance an assessment as preventive measure before falling in elderly population as a routine practice
2. To promote the use of proactive balance training as a tool to improve balance among elderly community
3. To promote the use of the current outcome measures as a tools to assess balance, as a proxy to measure the falling risk among elderly population

For future researchers

The researcher is recommending the following:

1. To evaluate the efficacy of applying this program by the patients at home program setting, since most of the elderly are found there
2. Based on this study, we suggest future research to study the relationship between falling risk factors and fall efficacy as well as the effects of programs intended to address these concerns.
3. The association between the severity of diabetes and its possible association with less balance was not within the scope of this study, which leaves space for future research in this field. this also implies the importance of safety procedures while training balance in this category of patients.

For Clinicians at multidisciplinary team

When the patient is not in the physical therapy rehabilitation hall, he/she is encouraged to perform the exercises prescribed by the program under the supervision of a trained person, such as a nurse, during his/her rehabilitation period.

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Appendixes:

Appendix 1: Data Collection Sheet



Al – Quds University
Faculty of Health Professions
Physiotherapy department

**The effectiveness of proactive balance training
program in prevention of falling among elderly In
elderly rehabilitation center**

Prospective Cohort Study

فاعلية برنامج التدريب على التوازن الاستباقي في الوقاية من السقوط بين
كبار السن في مركز تأهيل المسنين

الدراسة تخص رسالة ماجستير للتطبيقات عابده حمدان دائرة العلاج الطبيعي/جامعة القدس

Participant Name: _____

Participant Code: _____

Date of Signature: _____

Section I: Personal Data

1. Name of participant:
2. Phone number:
3. Gender : Female Male
4. Age (in years):
5. Height (m):
6. Weight (Kg):
7. Body Mass Index "BMI" (Kg /m²):

Section II: Medical History

1. Other Diseases:.....
2. Current Medications :
3. Previous Surgery / Injuries :.....

Section III: Outcome Measures

Outcome measures	Pre	Post
Time Up & GO		
10 Meter Walk Test		
Berg Balance Scale		
Functional Reaching Test		
Fall Efficacy Scale		

Appendix 2: Time Up & Go Test

ASSESSMENT

Timed Up & Go (TUG)

Purpose: To assess mobility

Equipment: A stopwatch

Directions: Patients wear their regular footwear and can use a walking aid, if needed. Begin by having the patient sit back in a standard arm chair and identify a line 3 meters, or 10 feet away, on the floor.

① Instruct the patient:

When I say "Go," I want you to:

1. Stand up from the chair.
2. Walk to the line on the floor at your normal pace.
3. Turn.
4. Walk back to the chair at your normal pace.
5. Sit down again.

NOTE:
Always stay by the patient for safety.

② On the word "Go," begin timing.

③ Stop timing after patient sits back down.

④ Record time.

Time in Seconds: _____

An older adult who takes ≥ 12 seconds to complete the TUG is at risk for falling.

CDC's STEADI tools and resources can help you screen, assess, and intervene to reduce your patient's fall risk. For more information, visit www.cdc.gov/steadi

Patient _____

Date _____

Time _____ AM PM

OBSERVATIONS

Observe the patient's postural stability, gait, stride length, and sway.

Check all that apply:

- Slow tentative pace
- Loss of balance
- Short strides
- Little or no arm swing
- Steadying self on walls
- Shuffling
- En bloc turning
- Not using assistive device properly

These changes may signify neurological problems that require further evaluation.



Centers for Disease Control and Prevention
National Center for Injury Prevention and Control

2017

STEADI | Stopping Elderly Accidents, Deaths & Injuries

Appendix 3: Berg Balance Scale

Berg Balance Scale

About: This scale measures balance in older adults.

Items: 14

Equipment:

Yardstick
 One standard chair with arm rests
 One standard chair without arm rests
 Footstool/step
 Stopwatch or wristwatch
 15 foot walkway

Reliability: Cronbach's alphas were greater than 0.83 for stroke patients and 0.97 for elderly residents.

Scoring:

A five-point scale, a range of 0-4.
 0 = lowest level of function
 4 = highest level of function.
 Highest possible score = 56
 Score of < 45 indicates a greater risk of falling

41-56 = low fall risk
 21-40 = medium fall risk
 0-20 = high fall risk

Reference:

Berg K, Wood-Dauphinee S, Williams JI, Maki, B (1992). [Measuring balance in the elderly: validation of an instrument](#). Can. J. Pub. Health July/August supplement 2:S7-11

Norms:

Age (y)	Group	N	Mean	SD	CI
60-69	Male	1	51.0	—	35.3 - 66.7
	Female	5	54.6	0.5	47.6 - 61.6
	Overall	6	54.0	1.5	52.4 - 55.6
70-79	Male	9	53.9	1.5	48.7 - 59.1
	Female	10	51.6	2.6	46.6 - 56.6
	Overall	19	52.7	2.4	51.5 - 53.8
80-89	Male	10	41.8	12.2	36.8 - 46.8
	Female	24	42.1	8.0	38.9 - 45.3
	No Device	24	46.3	4.2	44.1 - 48.5
	Device	10	31.7	10.0	28.3 - 35.1
	Overall	34	42.0	9.2	38.8 - 45.3
90-101	Male	2	40.0	1.4	28.9 - 51.1
	Female	15	36.9	9.7	32.8 - 40.9
	No Device	7	45	4.2	40.9 - 49.1
	Device	10	31.8	7.6	28.4 - 35.2
	Overall	17	37.2	9.1	32.5 - 41.9

Lusardi, M.M. (2004). [Functional Performance in Community Living Older Adults](#). *Journal of Geriatric Physical Therapy*, 26(3), 14-22.

Berg Balance Scale

Name: _____ Date: _____

Location: _____ Rater: _____

ITEM DESCRIPTION	SCORE (0-4)
1. Sitting to standing	_____
2. Standing unsupported	_____
3. Sitting unsupported	_____
4. Standing to sitting	_____
5. Transfers	_____
6. Standing with eyes closed	_____
7. Standing with feet together	_____
8. Reaching forward with outstretched arm	_____
9. Retrieving object from floor	_____
10. Turning to look behind	_____
11. Turning 360 degrees	_____
12. Placing alternate foot on stool	_____
13. Standing with one foot in front	_____
14. Standing on one foot	_____
Total	_____

GENERAL INSTRUCTIONS

Please document each task and/or give instructions as written. When scoring, please record the lowest response category that applies for each item.

In most items, the subject is asked to maintain a given position for a specific time.

Progressively more points are deducted if:

- the time or distance requirements are not met
 - the subject's performance warrants supervision
 - the subject touches an external support or receives assistance from the examiner
- Subject should understand that they must maintain their balance while attempting the tasks. The choices of which leg to stand on or how far to reach are left to the subject. Poor judgment will adversely influence the performance and the scoring.

Equipment required for testing is a stopwatch or watch with a second hand, and a ruler or other indicator of 2, 5, and 10 inches. Chairs used during testing should be a reasonable height. Either a step or a stool of average step height may be used for item # 12.

Berg Balance Scale

1. SITTING TO STANDING

INSTRUCTIONS: Please stand up. Try not to use your hand for support.

- () 4 able to stand without using hands and stabilize independently
- () 3 able to stand independently using hands
- () 2 able to stand using hands after several tries
- () 1 needs minimal aid to stand or stabilize
- () 0 needs moderate or maximal assist to stand

2. STANDING UNSUPPORTED

INSTRUCTIONS: Please stand for two minutes without holding on.

- () 4 able to stand safely for 2 minutes
- () 3 able to stand 2 minutes with supervision
- () 2 able to stand 30 seconds unsupported
- () 1 needs several tries to stand 30 seconds unsupported
- () 0 unable to stand 30 seconds unsupported

If a subject is able to stand 2 minutes unsupported, score full points for sitting unsupported. Proceed to item #4.

3. SITTING WITH BACK UNSUPPORTED BUT FEET SUPPORTED ON FLOOR OR ON A STOOL

INSTRUCTIONS: Please sit with arms folded for 2 minutes.

- () 4 able to sit safely and securely for 2 minutes
- () 3 able to sit 2 minutes under supervision
- () 2 able to sit 30 seconds
- () 1 able to sit 10 seconds
- () 0 unable to sit without support 10 seconds

4. STANDING TO SITTING

INSTRUCTIONS: Please sit down.

- () 4 sits safely with minimal use of hands
- () 3 controls descent by using hands
- () 2 uses back of legs against chair to control descent
- () 1 sits independently but has uncontrolled descent
- () 0 needs assist to sit

5. TRANSFERS

INSTRUCTIONS: Arrange chair(s) for pivot transfer. Ask subject to transfer one way toward a seat with armrests and one way toward a seat without armrests. You may use two chairs (one with and one without armrests) or a bed and a chair.

- () 4 able to transfer safely with minor use of hands
- () 3 able to transfer safely definite need of hands
- () 2 able to transfer with verbal cueing and/or supervision
- () 1 needs one person to assist
- () 0 needs two people to assist or supervise to be safe

6. STANDING UNSUPPORTED WITH EYES CLOSED

INSTRUCTIONS: Please close your eyes and stand still for 10 seconds.

- () 4 able to stand 10 seconds safely
- () 3 able to stand 10 seconds with supervision
- () 2 able to stand 3 seconds
- () 1 unable to keep eyes closed 3 seconds but stays safely
- () 0 needs help to keep from falling

7. STANDING UNSUPPORTED WITH FEET TOGETHER

INSTRUCTIONS: Place your feet together and stand without holding on.

- () 4 able to place feet together independently and stand 1 minute safely
- () 3 able to place feet together independently and stand 1 minute with supervision
- () 2 able to place feet together independently but unable to hold for 30 seconds
- () 1 needs help to attain position but able to stand 15 seconds feet together
- () 0 needs help to attain position and unable to hold for 15 seconds

Berg Balance Scale continued.....

8. REACHING FORWARD WITH OUTSTRETCHED ARM WHILE STANDING

INSTRUCTIONS: Lift arm to 90 degrees. Stretch out your fingers and reach forward as far as you can. (Examiner places a ruler at the end of fingertips when arm is 90 degrees. Fingers should not touch the ruler while reaching forward. The recorded measure is the distance forward that the fingers reach while the subject is in the most forward lean position. When possible, ask subject to use both arms when reaching to avoid rotation of the trunk.)

- () 4 can reach forward confidently 25 cm (10 inches)
- () 3 can reach forward 12 cm (5 inches)
- () 2 can reach forward 5 cm (2 inches)
- () 1 reaches forward but needs supervision
- () 0 loses balance while trying/needs external support

9. PICK UP OBJECT FROM THE FLOOR FROM A STANDING POSITION

INSTRUCTIONS: Pick up the shoe/slipper, which is placed in front of your feet.

- () 4 able to pick up slipper safely and easily
- () 3 able to pick up slipper but needs supervision
- () 2 unable to pick up but reaches 2.5 cm (1-2 inches) from slipper and keeps balance independently
- () 1 unable to pick up and needs supervision while trying
- () 0 unable to try/needs assist to keep from losing balance or falling

10. TURNING TO LOOK BEHIND OVER LEFT AND RIGHT SHOULDERS WHILE STANDING

INSTRUCTIONS: Turn to look directly behind you over toward the left shoulder. Repeat to the right. Examiner may pick an object to look at directly behind the subject to encourage a better twist turn.

- () 4 looks behind from both sides and weight shifts well
- () 3 looks behind one side only other side shows less weight shift
- () 2 turns sideways only but maintains balance
- () 1 needs supervision when turning
- () 0 needs assist to keep from losing balance or falling

11. TURN 360 DEGREES

INSTRUCTIONS: Turn completely around in a full circle. Pause. Then turn a full circle in the other direction.

- () 4 able to turn 360 degrees safely in 4 seconds or less
- () 3 able to turn 360 degrees safely one side only 4 seconds or less
- () 2 able to turn 360 degrees safely but slowly
- () 1 needs close supervision or verbal cueing
- () 0 needs assistance while turning

12. PLACE ALTERNATE FOOT ON STEP OR STOOL WHILE STANDING UNSUPPORTED

INSTRUCTIONS: Place each foot alternately on the step/stool. Continue until each foot has touch the step/stool four times.

- () 4 able to stand independently and safely and complete 8 steps in 20 seconds
- () 3 able to stand independently and complete 8 steps in > 20 seconds
- () 2 able to complete 4 steps without aid with supervision
- () 1 able to complete > 2 steps needs minimal assist
- () 0 needs assistance to keep from falling/unable to try

13. STANDING UNSUPPORTED ONE FOOT IN FRONT

INSTRUCTIONS: (DEMONSTRATE TO SUBJECT) Place one foot directly in front of the other. If you feel that you cannot place your foot directly in front, try to step far enough ahead that the heel of your forward foot is ahead of the toes of the other foot. (To score 3 points, the length of the step should exceed the length of the other foot and the width of the stance should approximate the subject's normal stride width.)

- () 4 able to place foot tandem independently and hold 30 seconds
- () 3 able to place foot ahead independently and hold 30 seconds
- () 2 able to take small step independently and hold 30 seconds
- () 1 needs help to step but can hold 15 seconds
- () 0 loses balance while stepping or standing

14. STANDING ON ONE LEG

INSTRUCTIONS: Stand on one leg as long as you can without holding on.

- () 4 able to lift leg independently and hold > 10 seconds
- () 3 able to lift leg independently and hold 5-10 seconds
- () 2 able to lift leg independently and hold \geq 3 seconds
- () 1 tries to lift leg unable to hold 3 seconds but remains standing independently.
- () 0 unable to try or needs assist to prevent fall

() TOTAL SCORE (Maximum = 56)

Appendix 4: Fall Efficacy Scale – International

FES-I

الآن نود أن نطرح بعض الأسئلة عن درجة حذرك من إمكانية الوقوع، الرجاء الإجابة مع الأخذ بعين الاعتبار طريقة قيامك بالنشاط. إذا كنت في الوقت الحاضر لا تقوم/ين بأداء النشاط بنفسك (على سبيل المثال يقوم شخص آخر بالتسوق عنك)، الرجاء الإجابة لتبيين درجة حذرك من إمكانية الوقوع عند القيام بالنشاط بنفسك. الرجاء وضع علامة في المربع الأقرب لرأيك عن درجة حذرك من إمكانية الوقوع عند القيام بالنشاط.

حذر جداً 4	حذر 3	حذر نوعاً ما 2	غير حذر على الإطلاق 1		
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	تنظيف المنزل (مثلاً الكنس، المسح أو نفض الغبار)	1
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	ارتداء الملابس أو خلعها (تغيير الملابس)	2
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	تحضير وجبات طعام بسيطة	3
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	الاستحمام	4
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	الذهاب إلى الدكان أو إلى محل تجاري	5
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	النهوض عن أو الجلوس على كرسي	6
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	صعود أو نزول الدرج	7
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	التنزه أو المشي في الحي	8
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	تناول شيء من مكان عالٍ أو من على الأرض	9
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	الذهاب للرد على الهاتف قبل أن يتوقف عن الرنين	10
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	المشي على أرضية أو سطح زلق (مبتل أو جليدي)	11
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	زيارة صديق أو قريب	12
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	المشي في مكان مزدحم بالناس والمشاة	13
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	المشي على سطح غير مستو (كطريق صخرية أو غير ممهدة بشكل جيد)	14
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	المشي على طريق منحدر صعباً أو نزولاً	15
<input type="checkbox"/> 4	<input type="checkbox"/> 3	<input type="checkbox"/> 2	<input type="checkbox"/> 1	الخروج للمشاركة في مناسبة اجتماعية (عائلية أو دينية أو أخرى)	16

FES-I translated to Arabic by Dr. Hadeel Halaweh from Yardley L, Todd C, et al. 2005; doi:<https://doi.org/10.1093/ageing/afi196>

Appendix 5: 10 Meter Walk Test

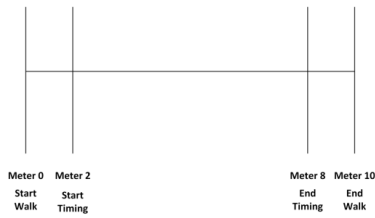
Timed 10-Meter Walk Test

General Information:

- individual walks without assistance 10 meters (32.8 feet) and the time is measured for the intermediate 6 meters (19.7 feet) to allow for acceleration and deceleration
 - start timing when the toes of the leading foot crosses the 2-meter mark
 - stop timing when the toes of the leading foot crosses the 8-meter mark
 - 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
- can be performed at preferred walking speed or fastest speed possible
 - documentation should include the speed tested (preferred vs. fast)
- collect three trials and calculate the average of the three trials

Set-up (derived from the reference articles):

- measure and mark a 10-meter walkway
- add a mark at 2-meters
- add a mark at 8-meters



Patient Instructions (derived from the reference articles):

- Normal comfortable speed: "I will say ready, set, go. When I say go, walk at your normal comfortable speed until I say stop"
- Maximum speed trials: "I will say ready, set, go. When I say go, walk as fast as you safely can until I say stop"

10 Meter Walk Testing Form

Name: _____

Assistive Device and/or Bracing Used: _____

Date: _____

Seconds to ambulate 10 meters (only the middle 6 meters are timed)

Self-Selected Velocity: Trial 1 _____ sec. Fast Velocity: Trial 1 _____ sec.

Self-Selected Velocity: Trial 2 _____ sec. Fast Velocity: Trial 2 _____ sec.

Self-Selected Velocity: Trial 3 _____ sec. Fast Velocity: Trial 3 _____ sec.

Self-Selected Velocity: Average time _____ sec. Fast Velocity: Average time _____ sec.

Actual velocity: Divide 6 by the average seconds

Average Self-Selected Velocity: _____ m/s

Average Fast-Velocity: _____ m/s

Date: _____

Seconds to ambulate 10 meters (only the middle 6 meters are timed)

Self-Selected Velocity: Trial 1 _____ sec. Fast Velocity: Trial 1 _____ sec.

Self-Selected Velocity: Trial 2 _____ sec. Fast Velocity: Trial 2 _____ sec.

Self-Selected Velocity: Trial 3 _____ sec. Fast Velocity: Trial 3 _____ sec.

Self-Selected Velocity: Average time _____ sec. Fast Velocity: Average time _____ sec.

Actual velocity: Divide 6 by the average seconds

Average Self-Selected Velocity: _____ m/s

Average Fast-Velocity: _____ m/s

Appendix 6 : Consent Form



Informed consent to participate in Research

نموذج الموافقة على المشاركة في البحث

اسم البحث: فاعلية برنامج التدريب على التوازن الاستقبالي في الوقاية من السقوط بين كبار السن في مراكز تأهيل المسنين.

اسم الباحث : عليده راند حمدان

Patient name:

Patient code:

Evaluator name: _____

Date of evaluation and signature: _____

عزيزي المشارك /المشاركة:

توثيقك انذاه على نموذج الموافقة هذا هو بموجب موافقة مكتوبة وموقعة على المشاركة في دراسة بحثية التي تقوم بها الباحثة عليده راند حمدان حول " فاعلية برنامج التدريب على التوازن الاستقبالي في الوقاية من السقوط بين كبار السن في مراكز تأهيل المسنين." و هو إقرار بيه قد تم شرح أهداف البحث وطريقة الفحص و التدخل العلاجي للبحث، وأنه قد تم شرح حقوقك المتضمنة:

- سرية المعلومات التي تصرح بها وعدم إطلاع اي شخص عليها و تخزينها في مكان امن لا يصل اليه سوى الباحث.
- إخفاء هوية المشارك في تحليل البحث و النتائج.
- استخدام المعلومات للأغراض العلمية فقط.
- حرية إنسحابك في اي وقت من الدراسة ومن دون الحاجة لإبداء الأسباب ودون أية عواقب شخصية او مالية.
- حفظ في الإطلاع على نتيجة فحوصاتك و نتائج البحث النهائية.

وأنه في حال كان لديك أسئلة حول الدراسة او حول اي معلومة متعلقة بها، يرجى الاتصال بالباحثة:
عليده حمدان على رقم التلنوين: 0528776127

موافقة المشارك

لقد تم وصف الدراسة البحثية لي شفويا، وبما فيه المعلومات المدرجة أعلاه، وأوافق على المشاركة بهذه الدراسة البحثية. سوف أحصل على نسخة موقعة من هذا النموذج للاحتفاظ بها في سجلاتي، أوافق على المشاركة بهذه الدراسة.

اسم المشارك الرباعي: _____

توقيع المشارك: _____ التاريخ: _____

اسم وتوقيع الشاهد: _____ التاريخ: _____

Appendix 7: Research Information Sheet



نموذج تعريف ومعلومات عن البحث

اسم البحث: فاعلية برنامج التدريب على التوازن الاستباقي في الوقاية من السقوط بين كبار السن في مراكز تأهيل المسنين.

اسم الباحثة: عايدة راشد حمدان .

تحية طيبة وبعد

نشكر لكم استعدادكم للمشاركة بهذا البحث، الذي هو جزء من دراسة الماجستير في العلاج الطبيعي في جامعة القدس. هذا البحث يهدف إلى التعرف على مدى فاعلية برنامج التدريب على التوازن الاستباقي في الوقاية من السقوط بين كبار السن في مراكز تأهيل المسنين .

معلومات عن طبيعة الدراسة والبرنامج الذي سيتم تقييمه في الوقاية من السقوط بين كبار السن في مراكز

تأهيل المسنين:

من خلال هذه الدراسة ، نهدف إلى تقييم فاعلية برنامج التدريب على التوازن الاستباقي في الوقاية من السقوط بين كبار السن المتبع في مركز التأهيل للمسنين جولدن كير في مدينة يافا . حيث أن هذا البرنامج هو برنامج التدخل اليومي المجدول والمتبع بانتظام في مركز التأهيل ، والذي يتم إجراؤه على مدار فترة إعادة التأهيل بالكامل (8 أسابيع) ، هو كما يلي: 5 جلسات تدريبية في الأسبوع ، 300 دقيقة من حجم التدريب (إجمالي الوقت الذي يقضيه في التمرين كل أسبوع) ، و 60 عدد دقائق من حجم التدريب في كل

جلسة تدريبية ، والتي تشمل تدريب مكثف على التوازن الاستباقي لمدة 50 دقيقة / جلسة (إجمالي مدة التدريب في الأسبوع - 250 دقيقة) ، يقومون بتدريب تمارين توازن مختلفة بمستويات صعوبة مختلفة بما في ذلك: قاعدة الدعم: مستقرة إلى غير مستقرة (بدءاً من المشية العادية إلى المشية الضيقة إلى المشية التردافية) ، وضعية القدمين (على سبيل المثال ، الوسطي أو الجانبي ، تغيير الوزن ، على الكعب أو أصابع القدم) ، السطح (من التابت إلى غير المستقر) ، المهام المزدوجة / المتعددة (المهام الحركية والمعرفية الإضافية) ، سرعة الحركة (انخفاض أو زيادة سرعة التنفيذ مثل سرعة المشي) ، المعدات: (استخدام الكرة ، الأريطة العلاجية المرنة TheraBand ، الأوزان الحرة ، وسادة التوازن ، blazpod) ، التغيير في الاتجاهات (للأمام ، للخلف ، إلى اليسار أو اليمين ، قطري) ، الإيقاع (بطيء ، متقطع) ، السرعة (سريع) ، ومع التقدم في التأهيل والتدريب ، يتم بعد ذلك الجمع بين مهام التوازن وأنشطة الحياة اليومية (مثل المشي للخلف بعيون مغلقة ، السعوط للطابق العلوي للخلف ، والسير مع منع كرة التنس في المضرب من السقوط على الأرض) ، وتمارين التقوية لمدة 10 دقائق (تركز على عضلات الفخذ ، عضلات الجذع ، عضلات الساق) . من المهم الإشارة إلى أن الجلسة تتكون في الغالب من ثمانية تمارين توازن تختلف كما ذكرنا أعلاه وتعتمد على الهدف من الجلسة (بين 10-20 تكرار لكل منها) ، والتي تستغرق حوالي 50 دقيقة في اليوم . يتم تحديد الهدف وشدة التدريب بشكل فردي . هناك احتمال ضئيل جداً بأن المشاركين سيصابون بعدم التوازن وسقوطهم خلال الاختبار أو التدخل لأن هذا التدريب ليس له أي آثار جانبية أو تعريض المريض للخطر . لضمان سلامة المريض أثناء أداء هذه المهام ، سيتم استخدام تدابير السلامة المناسبة . بالإضافة إلى ذلك ، سيتم التدريب أخصائيو العلاج الطبيعي المعتمدون والمؤهلون فقط من قبل المركز . و سيقوم الباحث الرئيسي بإجراء الفحوصات قبل وبعد التدريب .

من الجدير التأكيد على التالي :

- تدخل العلاج الطبيعي ليس له أي آثار جانبية أو تعريض المريض للخطر من المهم أن تقوم بالتمارين وأن تبيع النصيحة التي يمنحك إياها المعالج الخاص بك من أجل الشفاء الأمثل .
- المعالج الخاص بك مؤهل لهذا النوع من التدريب و هو جزء من برنامجك خلال فترة تأهيلك و ان الهدف من الدراسة يقتصر على دراسة فعالية هذا البرنامج بدون أي تدخل في طبيعته .
- إذا كنت سعيداً بمتابعة العلاج على النحو الذي اقترحه اخصائي العلاج الطبيعي ، واجابك على الأسئلة التي ترغب في معرفة اجابتها ، و موافقاً على المشاركة في الدراسة يرجى التوقيع على

نموذج الموافقة المرفق وتسلّمها إلى اخصائي العلاج الطبيعي. والاحتفاظ بهذه النشرة بسجلاتك الخاصة.

- طبيعة الفحوصات التي سوف تستخدم في هذا البحث هي فحوصات آمنة ولا يوجد منها أي ضرر على المريض.
- سيكون هناك فحص قبل التدخل العلاجي و بعده.
- تحدث إلى عائلتك وأصدقائك حول هذا الموضوع وخذ وقتك لاتخاذ القرار . إذا قررت المشاركة ، يجب عليك توقيع هذا النموذج لإظهار رغبتك في المشاركة.
- إن قرار عدم المشاركة أو قرار منخدة الدراسة لاحقاً لن يؤدي إلى أي عتوبه أو يؤثر على الرعاية الصحية الحالية أو المستقبلية.
- إن اشراكك في هذا البحث هو طوعي و مرتبط بتوقيعكم على نموذج موافقة بالمشاركة وتصريح فهمكم لطبيعة البحث، فحوصاته، وفي حال وجود اي استفسار عن البحث او اي شيء متعلق بهذه الدراسة، يرجى التواصل مباشرة مع الباحثة (أ. عايدة حمدان) على الرقم

التالي 0528776127

شاكرين لكم حسن تعاونكم

عايدة حمدان
اخصائية علاج طبيعي
طالبة ماجستير علاج طبيعي
جامعة القدس

Appendix 8 : Functional Reaching Test

Functional Reach Test



The Functional Reach Test is a single item test developed as a quick screen for balance problems in older adults.

Interpretation:

A score of 6 or less indicates a significant increased risk for falls.

A score between 6-10 inches indicates a moderate risk for falls.

Age related norms for the functional reach test:

Age	Men (in inches)	Women (in inches)
20-40yrs	16.7 ± 1.9	14.6 ± 2.2
41-69yrs	14.9 ± 2.2	13.8 ± 2.2
70-87	13.2 ± 1.6	10.5 ± 3.5

Requirements:

The patient must be able to stand independently for at least 30 seconds without support and be able to flex the shoulder to at least 90 degrees.

Equipment and Set up:

A yard stick is attached to a wall at about shoulder height. The patient is positioned in front of this so that upon flexing the shoulder to 90 degrees, an initial reading on the yard stick can be taken. The practitioner takes a position 5-10 feet away from the patient, viewing the patient from the side.

Instructions:

Position the patient close to the wall so that he or she may reach forward along the length of the yardstick. The patient is instructed to stand with feet shoulder distance apart then make a fist and raise the arm up so that it's parallel to the floor. At this time, the practitioner takes an initial reading on the yard stick, usually spotting the knuckle of the third metacarpal. The patient is instructed to reach forward along the yardstick without moving the feet. Any reaching strategy is allowed, but the hand should remain in a fist. The practitioner takes a reading on the yardstick of the farthest reach attained by the patient without taking a step. The initial reading is subtracted from the final to obtain the functional reach score.

References:

1. Duncan, PW, Weiner DK, Chadler J, Studenske S. Functional reach: A new clinical measure of balance. J Gerontol. 1990; 45:M192.
2. Duncan, PW, et al: Functional reach: Predictive validity in a sample of elderly male veterans. J Gerontol. 1992; 47:M93.
3. Mann, GC, et al: Functional reach and single leg stance in patients with peripheral vestibular disorders. J Vestib Res. 1996; 6:343.
4. Weiner, DK, et al: Does functional reach improve with rehabilitation. Arch Phys Med Rehab. 1993; 74:796.

Appendix 9: Research Ethics Approval



Research Ethics Subcommittee of Faculty of Health Professions
Letter of approval

Feb. 14, 2023
Ref. No.: RESC/2023-7

Dear Applicants, (Dr. Akram Amro, Ms. Ayda Hamdan)
Program: MSc Physiotherapy Department

The Research Ethics subcommittee of the Faculty of Health Professions has recently reviewed your proposal entitled **(The effectiveness of proactive balance training program in prevention of falling among elderly in elderly rehabilitation centers - Prospective Cohort Study)** submitted by **(Dr. Akram Amro)**. Your proposal is deemed to meet the requirements of research ethics at Al-Quds University, but further assessment is required by the Central Research Ethics Committee of Al-Quds University. We wish you all best for the conduct of the project.

Hussein ALMasri
Research Ethics Subcommittee Chair
Faculty of Health Professions

Hussein ALMasri

CC: File
CC: Committee members