ISTANBUL MEDIPOL UNIVERSITY

GRADUATE SCHOOL OF HEALTH SCIENCES

THESIS OF MASTER'S DEGREE

ASSESSEMENT OF BALANCE IN GERIATRIC HYPERTENSIVE INDIVIDUALS

FARZIN HAJEBRAHIMI, PT

DEPARTMENT OF PHYSICAL THERAPY AND REHABILITATION

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Declaration

I hereby declare that this thesis is my own study, in all steps of the thesis from planning to writing, I have not done anything out of the ethical behaviors, I have obtained all of the information of this thesis inside the academic and ethical principles, I have shown references to all of the information and comments that were reached other out of this thesis study and have shown these references at the section of references, also I have not done any behavior infringing patent and copyright during the performing and writing of this theses.

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Abbreviations and Symbols

ABC: Activities-Specific Balance Confidence Scale

TUG: Timed Up and Go

BESTest: Balance Evaluation Systems Test

PPA: Physiological Profile Approach

GDS: Geriatric Depression Scale

ADL: Activities of Daily Living

BADL: Basic activities of daily living

MMSE: Mini-Mental State Examination

BMI: Body Mass Index

SBP: Systolic Blood Pressure

DBP: Diastolic Blood Pressure

CoP: Center Of Pressure

SPSS: Software Package Used For Statistical Analysis

HT: Hypertension

SLB: Single Leg Balance

WFA: Wii Fit Age

CES-D: Epidemiologic Studies Depression Scale

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1. ABSTRACT

THE EVALUATION OF THE BALANCE IN GERIATRIC HYPERTENSIVE INDIVIDUALS

Our study is designed to evaluate the relationship between the balance performance of the geriatric hypertensive and normotensive individuals and find out the effect of hypertension in the balance behavior of the elderly people. 61 geriatric people were included in our study. All the patients were 65 years old and older and were participating to our study with their own approval. Demographic information of the participants has been recorded. Basic activities of daily living is measured by the KATZ Index of ADLs, cognitive status is measured by Standardized Mini-Mental State Examination, depression status is measured by Geriatric Depression scale, Quadriceps muscle strength is measured by hand held dynamometer, ankle dorsiflexion range of motion is measured by goniometer, gait is measured by Timed Up and Go Test and balance performance is measured by Nintendo Wii and Pedalo® Sensamove balance device. The systolic and diastolic blood pressure is measured before the balance test. Hypertensive group had higher performance time in Timed Up and Go test than normotensive. ($p=0.030$). There was no statistically significant difference in parameters of Pedalo® Sensamove device between hypertensive and normotensive participants ($p>0.05$). Parameters of "Completed seconds in Wii Single Leg Balance Test", "Performance score in Wii Single Leg Balance Test" and "Wii fit age" between both hypertensive and normotensive were determined significant in the statistical analysis ($p<0.05$). Hypertension seems to affect different parameters of balance among elderly people. For controlling their balance, elderly people should consider their high blood pressure beside their falling history.

Key Words: balance, elderly, geriatrics, hypertension, Wii

2. ÖZET

HİPERTANSİF GERİATRİK BİREYLERDE DENGE DEĞERLENDİRMESI

Çalışmamız hipertansif ve normotansif geriatric bireylerde denge performansınının ilişkisini ve hipertensiyonun yaşlı bireylerin dengeleri üzerinde etkisini araştırmak için planlanmıştır. Çalışmamıza 61 geriatrik birey dahil edilmiştir. Çalışmaya katılanların hepsi 65 yaş üstü olup gönüllü olarak araştırmayı kabul etmişlerdir. Katılanların demografik bilgileri kaydedilmiştir. Temel günlük yaşam aktivitelerini ölçmek için "Katz indeksi", Kognitif durumu ölçmek için "Statdardize Mini Mental Testi (SMMT)", Depresyon durumunu ölçmek için "Geriatrik Depresyon Skalası", Quadriceps kas gücünü ölçmek için hand held dinamometre, ayak bileği eklem hareketi açıklığını ölçmek için goniometre, yürümeyi değerlendirmek için "Zamanlı Kalk ve Yürü Testi (ZKYT)", ve dengeyi ölçmek için Nintendo Wii ve Pedalo® Sensamove denge cihazı kullanılmıştır. Denge testinden önce bireylerin sistolik ve diastolik kan basınçları ölçulmüştür. Hipertansif grubun ZKYT test sonuçları normotansif gruba göre daha kötü bulunmuştur($p=0.030$). Pedalo denge değerleri ve hipertasiyon arasında herhangi bir anlamlı fark saptanmamıştır ($p>0.05$). Nintendo Wii cihazında, "Wii single leg balance seconds", "Wii single leg balance performance" ve "Wii fit Age" parametrelerinde hipertansif ve normotansif grupları arasında anlamlı fark saptanmıştır($p<0.05$). Hipertansif bireyler Wii denge parametrelerine göre daha kötü performans göstermişlerdir. Hipertansiyonun yaşlı bireylerde dengenin farklı parametrelerini etkilediği belirlenmiştir. Dengeyi sağlamak için, yaşlı bireylerin daha önce düşme yaşamalarının yanısıra yüksek tansiyonlarına da dikkat etmeleri gerekmektedir.

Anahtar Sözcükler: denge, geriatrik, hipertansiyon, Wii, yaşlı

3. INTRODUCTION AND PURPOSE

According to annual report of the World Health Organization on 2015, cardiovascular diseases can be named as the first cause of the deaths worldwide. It is important because many people die each year because of cardiovascular diseases and the amount of these deaths are more than any other deaths.

Nearly 17.5 million people died from cardiovascular diseases in 2012, which were the 31% of all deaths. Of these deaths, an estimated of 7.4 million were due to coronary heart disease and 6.7 million were due to stroke.

Importantly, among all the annual cardiovascular deaths, hypertension account for 9.4 million deaths worldwide every year. Hypertension is responsible for at least 45% of deaths due to heart disease and 51% of deaths due to stroke.

Normal aging is associated with decreased ability to maintain postural stability in standing position. Therefore the inability to control the postural balance leads to disturbed balance conditions in the older people and consequently causes fallings among older population.

Falling is one of the most important problems of elderly people. The incidence of falling is reported to be high among elderly people and the fear of falling is very common in elderly population. About one third of people aged 65 years and older report at least one fall each year.

Fallings lead to several fractures especially in hip, pelvic, humerus and forearm in the elderly people. Unfortunately the treatment of fracture is more difficult and time consuming in elderly people related to the young generation. Most of the times, because of the osteoporotic feature of the bones in these people, the fracture type is more complicated and the healing period becomes long and difficult.

The other important effect of falling is that the fear of falling is generated among the elderly people after the first falling and this matter results in their not going out of the house or even a sedentary lifestyle inside their home.

While imbalance, vertigo and dizziness are reported to be more common among elderly people, the balance performance of the elderly people should be investigated precisely.

The incidence of hypertension also increases with aging. Older people have usually higher blood pressure than young people and blood pressure is reported to increases with age.

Considering the higher incidence of hypertension and impaired balance in elderly people, this hypothesis has been generated that whether there is any relationship between hypertension factor and balance disorder among elderly people.

Several studies have been done to investigate the balance disorders of the hypertensive people, but the results are conflicting. Determination of the relationship between hypertension and postural balance in elderly adults can help to prevent the fall risks of this population and also improve their static and dynamic balance performance.

The aim of this thesis was to investigate the relationship between hypertension and postural balance among geriatric adults.

4. GENERAL INFORMATION

4.1. Aging

As a report of World Health Organization, people nowadays can expect to live into their 60s and even older than 60.

People older than 65 are accepted as the "elderly" or older persons. There is of course no general agreement of the specific age from which an individual becomes old. It is therefore generally accepted that the biological age and the calendar age of the individuals are not usually the same number, Bongaarts (1).

4.2. Falls

4.2.1. Background and epidemiology for falls-Incidence of falls

Falls occur very commonly among older people, even among those with good health and living independently in their homes and having no apparent balance problems. Falls and unstable balance are very common among older people that lead to serious clinical and health problems in this population.

The importance of falling in older people is more that which is obvious. Among those deaths which are not on purpose or arranged deaths, falls are listed in the fifth order. The other leading factors of deaths before falls are cardiovascular diseases, cancer, stroke, and pulmonary diseases. Importantly, falls constitute one third of these deaths.

In the United States, three of four deaths related to falls occur mostly in people age ≥65. More than one third of the people age ≥65 (About 40%) experience at least one fall each year. 1 in 40 of these people experiencing fall will be hospitalized because of that fall. Also repeated falls are actually common after the first fall and hospitalization.

The key facts of World Health Organization (WHO) related to falls which show the importance and seriousity of the falling in elderly people are as following:

- Falls are the second leading cause of accidental or unintentional injury deaths worldwide.
- Each year an estimated 424 000 individuals die from falls globally of which over 80% are in low- and middle-income countries.
- Adults older than 65 suffer the greatest number of fatal falls.
- 37.3 million Falls that are severe enough to require medical attention, occur each year.
- Prevention strategies should emphasize education, training, creating safer environments, prioritizing fall-related research and establishing effective policies to reduce risk, WHO (2).

The higher incidence of the falls in elderly people is not the only important matter needing consideration. As the younger people have more mobility and include in different sportive activities, they may actually experience more falls than elder people. The importance of falls among the elder people is that they are more susceptible to injuries because of some age-related complications such as osteoporosis. Therefore a very normal and mild falling sometimes results in dangerous circumstances. Aged people also have a longer recovery period and the inactivity in this period affects the healing process negatively which can result in further falls. This is also called post-fall anxiety syndrome in which patients have some exaggerated caution to control their activities in a way not to fall again that again results in their deconditioning and increased inactivity, Rubenstein et al (3). Studies have shown that 30%-73% of people who have experienced a fall before are fearing from falling again, King et al (4), Tinett et al (5), Vellas et al (6).

Adding to this, those elderly people who have several falls, are forced by the situation to lo-term hospitalization and then spend their remaining life time at nursing homes, Sattin et al (7).

Studies have shown that in those community-dwelling individuals who have had a fall-related hip fractures, 25% to 75% do not recover to their pre-fall situation and activities of daily living, Magaziner et al (8).

4.2.2. Causes and risk factors for falls

Several causes are listed related to falls in elderly people. The summary of the important causes of falls in elderly people is listed as follow:

- Accident'/environment-related
- Gait/balance disorders or weakness
- Dizziness/vertigo
- Drop attack
- Confusion
- Postural hypotension
- Visual disorder
- Syncope
- Other specified causes (arthritis, acute illness, drugs, alcohol, pain, epilepsy and falling from bed)
- Unknown causes

It is obvious that that the amount of vision and hearing and also other sensory inputs decreases as people get older and this also contribute to their insufficiency in controlling their balance in the case of instability. The strategies of controlling balance also changes in the aged people. In the elder people the hip strategy in which we shift our weights in the case of instability gives its place to the stepping strategy in which stepping takes place when there is an instable condition.

Proprioception has been shown to be diminished with age. Impaired proprioception makes it difficult for older people to detect the changes in body position. Proprioception may greatly influence postural stability, and a decline in proprioception with aging could be associated with an increased tendency to fall in the elderly people.

Postural balance includes such differing physiological aspects as sensory functions, motor coordination, high-level adaptive mechanism and musculoskeletal constrains.

The lower limbs are particularly important for maintaining postural stability. Visual system also plays a major role in postural control in elderly people.

There are changes in joints, muscles, connective tissue, and sensory input as people get older. These factors affect on walking and gait and therefore have great impact on balance. Control of balance is more difficult in the changing of these factors. Other than age-related factors, changes in nervous, cardiovascular and respiratory systems related consequent to inactivity of the elder people can also affect the gait and balance performance of the elderly people.

Balance is the most important component to maintain functional independency. It is defined as maintaining posture in an upright position and ability to move voluntarily.

Older people also experience dizziness very much. Dizziness is a non-specific problem and can be related to cardiovascular disorders, hyperventilation, orthostatic situation, drug side-effect, anxiety or depression. Usually as the blood pressure drops 20 mmHg of systolic blood pressure when the patient stands from the lying position, he/she feels dizziness and this is called orthostatic hypotension. Orthostatic hypotension can occur in 10-30% of normal elderly people which live at home but it affects falls less than this prevalence.

Some people also experience drop attacks without feeling any dizziness. In this situation they feel a sudden leg weakness and therefore they fall.

Patients also experience syncope after a decreased cerebral blood flow or metabolic factors. Syncope can cause 2 to 20% of the falls. The important thing about syncope is that those who fall with the syncope are hospitalized and been started the treatment immediately.

In order to identify the risk factors for falls some of the main risk factors of falling is listed as follow:

- Weakness
- Balance deficit
- Gait deficit
- Visual deficit
- Mobility limitation
- Cognitive impairment

- Impaired functional status
- Postural hypotension

Gait and balance deficit and weakness are the leading risk factors in this list. The changes in gait which occurs with aging, are known to be an important factor related to falls in the elderly people. The muscle weakness is mostly related to diseases and inactivity in elderly people rather than aging. Also those with gait and muscle dysfunction have a higher risk of falling and fractures, Rubenstein et al (3), Prevention et al (9), Robbins et al (10), Rubenstein et al (11), Rubenstein et al (12), Leipzig et al (13).

Fall-related mortality

Fall-related mortality increases dramatically as people get older, especially after age 70, (Hogue (14).

4.3. Postural Balance

Structural and functional declines of the somatosensory systems occur with increase in age and these changes are associated by postural stability.

Different impairments in sensory, motor and central system can lead to instability in older people. Impairments can consist of different pathologies that affect these systems or even the normal decline in functions related to aging.

Vision has a very great role in controlling balance, because by the inputs coming from the eyes we can imagine our special environment and this makes to control our balance. By different physiologic pathological changes and in eyes and visual mechanisms, as the individuals get older the vision becomes worse. This happens especially after the age 50, Gittings et al (15).
This is also emphasized by misinterpretation and misjudgment of the special map and the distances which altogether makes the balance worse, Lord et al (16).

Vestibular system which helps the balance by vestibule-ocular and vestibule-spinal pathways and correcting mechanisms related to this, also is affected as people get

older. Studies show that the function of the vestibular system decreases with the normal path of aging, Fife et al (17).

Although those being aware of their poor vestibular function have generated some compensatory reactions and precautions to control their balance but studies show that impaired vestibular function also leads to increase in the falls in the elderly people, Fabio (18), Kristinsdottir et al (19).

As people get older the body mass especially muscle mass becomes smaller gradually, Lexell, et al (20).

Muscle strength decreases also after the age 50 and the speed of this decrease continues a steep degree up to the age 80, Larsson et al (21).

This diminish in the muscle strength can cause impaired balance disorder in the elderly people. The strength of the muscles and speed of the muscle contraction are the affecting factors in the impairing postural balance. As the atrophy of the fast-twitch fibers is seen by aging, the speed of the reaction and muscle contraction in the case of any instability should be taken into consideration, Sturnieks et al (22).

Normal process of aging leads to decrease in postural stability during standing and those situations of any instability. The postural sway is defined as small deviations in the center of body mass. The postural sways can be therefore measured in order to assess the postural balance. In those young adults if we manipulate one of the visual, vestibular and proprioceptive systems, the compensation in the other systems result in the minimal changes of the center of mass. In the older people this manipulation results in greater changes of the postural sways (center of mass) and this shows that the compensation is not enough in their postural balance mechanism, Lord et al (23).

Studies have also shown that the amount of postural balance increases after the age 30, Sturnieks et al (24).

4.4. Balance Evaluation

The purpose of evaluation balance is first to determine if there is any balance disorder in the corresponding patient and second to find out the underlying reason of balance disorder.

The balance tools used in evaluation and assessment should have some features such as reliability, validity and be practical and easy to use.

Clinical balance assessments are divided into three methods:

- Functional Assessments
- Systems/Physiological Assessments
- Quantitative Assessments

Functional balance tests can measure balance performance by calculating some motor tasks. These tests whether contain some scales consisting of different tasks or consist of the time needed to complete a posture needing balance, Horak et al (25).

Here are some specialized clinical tests which are commonly in use:

- Activities-Specific Balance Confidence Scale (ABC)
- Berg Functional Balance Scale
- Tinetti Balance and Gait Assessment
- Timed Up and Go (TUG)
- One-leg stance
- Functional reach
- Balance Evaluation Systems Test (BESTest)
- Physiological Profile Approach (PPA)

In order to find out the underlying reason of the balance disorder, a systematic approach is useful, Horak et al (25).

The following tests use the systematic approach in order to assess balance:

- The Balance Evaluation Systems Test, Horak et al (26)
- The Physiological Balance Profile, Lord et al (27)

Objective and quantitative assessment tools in evaluating balance are as following:

- Posturography (which consists of Static and Dynamic Posturography)
- Wearable Inertial Sensors

Static posturography is designed to assess the postural sway while the patients stand still. This occurs by quantifying the changes in center of pressure of foot on a force plate.

Dynamic posturography uses external perturbations in balance or it uses changing surfaces or changing visual conditions. This makes them present some helpful information about forward and backward body sways and therefore make to find the underlying reason of the balance disorder. The disadvantages of these systems are their being expensive and time-consuming meanwhile their being very spacious. Also dynamic posturography does not provide any information about the balance disorders during walking, sitting to standing etc.

There are also some novel assessment systems that wireless wearable motion sensors are used to evaluate balance. These systems compensate the disadvantages of other computerized tools and can be used during different tasks such as walking, Bonato (28), Chiari et al (29), Mancini et al (30).

A portable, inexpensive balance assessment system that has widespread availability is always needed at the clinic.

The Wii Balance board has been shown to be a valid and reliable method to quantify the Center of Pressure displacement during balance tests in older adults. Also studies suggest that the Wii Balance Board is a valid tool for assessing standing balance. Given that the Wii Balance Board is portable, widely available and it can provide the clinicians with a standing balance assessment tool suitable for the clinical setting.

The Pedalo®-Sensamove Balance Test is also a useful assessment tool for evaluating standing balance. This device is easy to handle, records an immediate data evaluation about a performance reproduction in %, as well as a comprehensive data documentation of all test measurements in the XY axes for each patient. The detailed documentation of single and longtime statistics offers the visualization of the test results.

4.5. Hypertension

Hypertension which is known as high blood pressure is a worldwide health problem. Hypertension is the important factor in heart disease, stroke and can lead to mortality and disability.

Hypertension leads to 45% of deaths because of heart disease and 51% of deaths because of stroke, WHO (31).

In 2008 near 40% of people aging over 25 had been diagnosed with hypertension. However countries with high income have a lower prevalence of hypertension, Alwan (32).

The risk factors of hypertension are as following:

- Tobacco Use
- Obesity
- High Cholesterol
- Diabetes Mellitus

Hypertension can also lead to myocardial infarction, stroke, renal failure, and death in the case of not being detected early and treated in an appropriate manner.

The prevalence of hypertension increases by aging. Also the danger of cardiovascular and cerebrovascular diseases increases in those elderly people having hypertension

Blood pressure is measured in millimeters of mercury (mm Hg). The result is recorded as two numbers one representing systolic blood pressure and the other

diastolic blood pressure. Systolic blood pressure is the peak amount of the blood pressure which occurs when the heart contracts and diastolic blood pressure is the lowest blood pressure which occurs when the heart relaxes. This usually happens between the two heart beats. The normal values of blood pressure for adults are 120 mm Hg for systolic blood pressure and 80 mm Hg for diastolic blood pressure. Hypertension is defined when the systolic blood pressure is above 140 mm Hg and/or diastolic blood pressure above 90 mm Hg.

5. MATERIALS AND METHODS

5.1. Materials

This thesis was performed in Darülaceze Geriatric Center and Istanbul Medipol University.

Sixty one patients were included in this study. The aim of the study and all the assessments were full explained to the volunteer patients before beginning the evaluations. The assessments were done between August and December 2015.

This Thesis study got an approval decision of the ethical committee for noninvasive clinical studies of Istanbul Medipol University with the number 108400987-297 on 2015.06.02

The cases of this study were all informed about the purpose, duration, required assessments and scales of the study. The Informed Consent Form appropriate to the standards of the ethical committee of the clinical studies of Istanbul Medipol University were read and signed by all the patients.

Selection of the Cases

Inclusion Criteria

1) Age $\geq$ 65 years
2) Ability to perform self-care activities of daily living without difficulties or need for help and able to walk independently for at least 400 m without assistive device

Exclusion Criteria

1) Impaired cognitive status (<24 on Mini-Mental State Test score)
2) Neurological disorders (stroke with disabling outcomes, Parkinson's disease, multiple sclerosis)
3) Psychiatric disorders (depression or anxiety) requiring drug treatment; History of cardiovascular disease (including angina, myocardial infarction, congestive heart failure, but not controlled hypertension)
4) Active cancer

5) Kidney or liver diseases
6) Important sensory deficits (any condition that precluded subjects from being tested with
7) performance oriented disability scales or neuropsychological tests); Vestibular diseases
8) Previous lower limb surgery
9) Acute diseases
10) Diabetes requiring insulin or hypoglycemic drugs (subjects with impaired glucose tolerance, defined as serum fasting glucose values 110 mg/dl or higher but less than 140 mg/dl were included).

Presence of prior hypertension diagnosis was based on self-report of hypertension (answering "yes" to the question: "Has the doctor ever told you that you have hypertension?") or antihypertensive medication intake.

5.2. Methods

The number of included patients and process of grouping the patients is shown in Figure 5. 1.

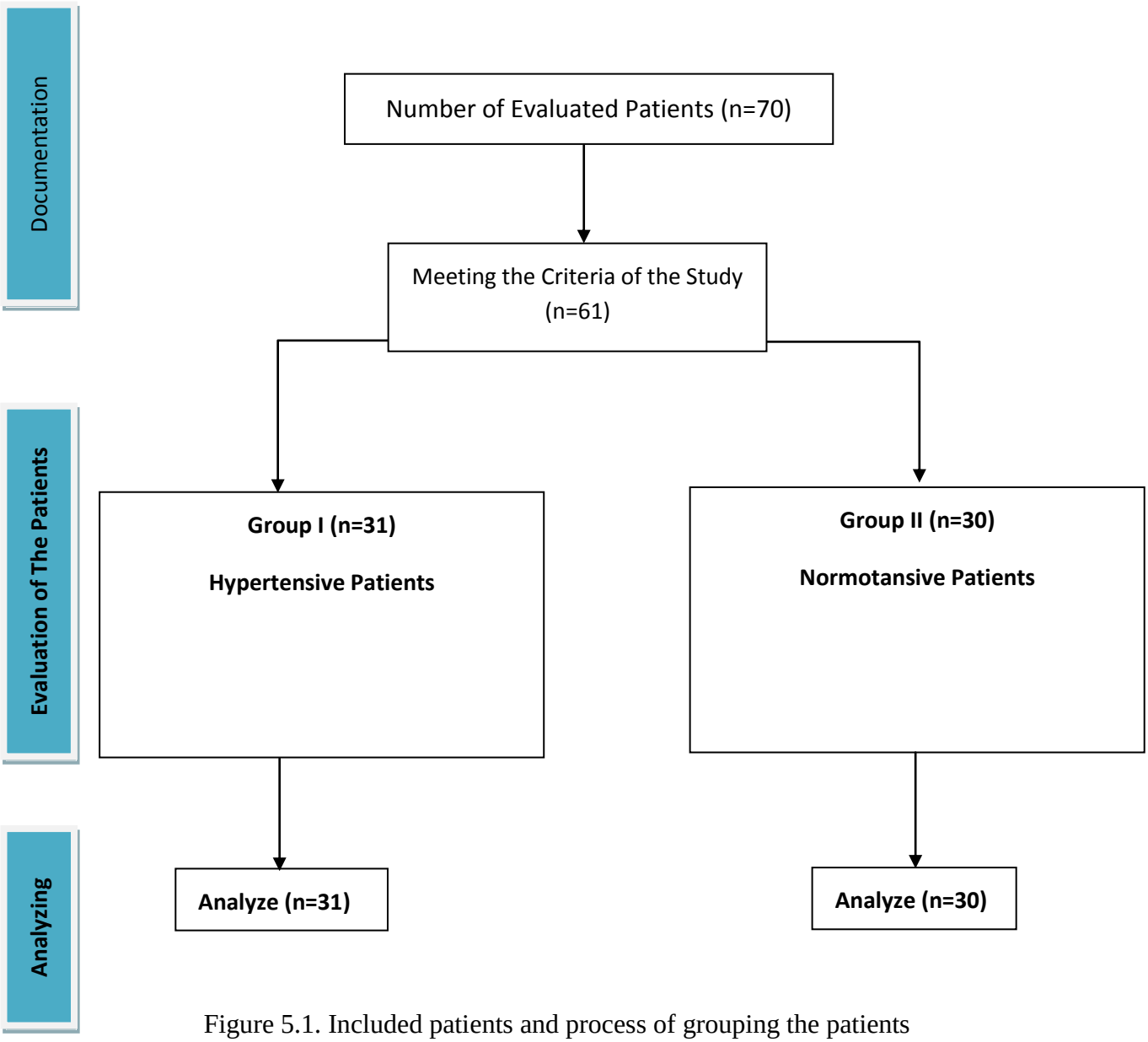

Figure 5.1. Included patients and process of grouping the patients

5.2.1. Applied Assessments and Evaluations

5.2.1.1 Patient Evaluation Form

In order to understand the personal information and history of the patients “patient evaluation form” was used. Patient evaluation form included the following items:

- Name-Surname
- date of born
- Age
- Gender
- Marital status
- Height
- Weight
- Body Mass Index
- Educational status
- Living condition
- Smoking and alcohol addictions
- Mobility status
- History of falling
- History of balance disorder

5.2.1.1. Geriatric Assessment

Geriatric global assessment was performed with a detailed medical history, reviewing all the medications. The long form of the Geriatric Depression Scale (GDS) was used to assess the depression status of the patients.

The participants' depressive symptoms were evaluated using the Turkish version of the GDS, Ertan et al (33), Lesher (34). GDS is a 30-item questionnaire which is specifically developed for elderly individuals. Researchers have found this instrument to be reliable and valid in multiple settings and have recommended it for use in nursing home populations, Ertan et al (35). Ertan et al. tested the validity and reliability of GDS scoring in the Turkish population and found it to be valid and

reliable, Orhan et al (36). A score ≥14 was accepted to be depressive in our study, Arik et al (37).

The purpose of using the Geriatric Depression Scale was to exclude those patients having depression. If a patient had depression he/she was excluded from the study.

5.2.1.2. KATZ Basic Activities of Daily Living

Basic activities of daily living (BADL) were evaluated according to (Katz et al., 1963), Koç (38). This index was developed by Katz in 1979. Clinicians typically use this tool to detect problems in performing Activities of Daily Living (ADL). ADL include self-care behaviors (e.g. eating, dressing and undressing, bathing, personal care, transferring from bed to chair and back, using the toilet, voluntarily controlling urinary and faucal discharge, walking, climbing up/down stairs) that should be performed every day. The scale consists of performance of six functions: bathing, dressing, toileting, transferring, continence, and feeding. Clients indicated their being independent or dependent in each of the six functions, Martin et al (39).

5.2.1.3. Muscle Strength

Isometric muscle strength was assessed at both Quadriceps muscles with Hand-Held Dynamometry. In order to measure isometric Quadriceps Femoris strength using hand-held Dynamometer all patients were lying supine. The test was performed with applying force to the lower extremity of the patients.

The Manual Muscle Tester is a Microprocessor controlled device which records the peak force performed by the patient. All of the measurements were performed by the researcher.

The supine technique is both easier for the participants to perform and also easier for the physiotherapist to stabilize and maintain the testing position, Folstein et al (40).

5.2.1.4. Range of Motion

Range of motion related to ankle joint was assessed by all patients lying in supine position and measuring their range of active dorsiflexion by using a manual goniometer.

5.2.1.5. Cognitive Assessment

The Mini-Mental State Examination (MMSE) was administered as a measure of overall cognitive performance. The Turkish version of the
MMSE, which was previously proven to be valid and reliable among the Turkish people was used in our study, Tezel et al (41).

This test is a 30-point questionnaire that is used extensively in clinical and research settings to measure cognitive impairment.

Advantages of the MMSE:

- Requiring no specialized equipment or training for administration
- Due to its short administration period and ease of use, it is useful for cognitive assessment in the clinician's office space or at the bedside

Disadvantages of the MMSE:

- It is affected by demographic factors; age and education exert the greatest effect.
- İt lacks the sensitivity to measure mild cognitive impairment.

Scores greater than or equal to 27 points (out of 30) indicates a normal cognition. Scores below that can indicate severe (≤9 points), moderate (10–18 points) or mild (19–24 points) cognitive impairment. Scores>23 were accepted to include in our study matching the including criteria.

The purpose of using the MMSE was to exclude those patients having lower cognitive performance.

5.2.1.6. BMI Assessment

A standardized measure of the height and weight was performed and from those data the body mass index (BMI) was calculated.

5.2.1.7. Measurement of the Blood Pressure

Systolic and diastolic blood pressures (SBP and DBP, respectively) were computed as the mean values of the three measures taken during the assessment. Hypertension was defined as the presence of at least one of the following features:

1. SBP > 140 mmHg or DBP > 90 mmHg on clinical examination;

2. History of hypertension;
3. Current use of antihypertensive drugs

In order to test the balance performance of the patients “Timed Up and Go” test was performed for all of the patients. TUG test is widely used during the evaluation process of the elderly people. TUG test is the shortest and simplest clinical balance test but at the same time is the most reliable test, Yelnik et al (42).

This test is reliable and valid for quantifying functional mobility that may also be useful in following clinical change over time. The test is quick, requires no special equipment or training, and is easily included as part of the routine medical examination.

The test consist of different mobility tasks such as walking with the straight head, turning, sit to stand, stand to sit which require controlling balance. The patient sits on a standard chair, and then he/she stands up and walks in line of 3 meters, then turns around at the line, walks back to the chair and sits down. The test starts when we say go, and stops with the patient’s buttocks touch the seat. The time of this action is recorded in seconds.

5.2.1.8. Nintendo Wii

All the patients underwent the Nintendo Wii balance test.

At the beginning of the test, demographic information of the patient is imported to the device. These information include the birth date, gender and height of the patients. The weight is not included because the Wii balance board is able to measure the weight of the individual who has stood on the board.

In order to better feel the environment of the testing and also realize the virtual concept of the test we used a video projector to reflect the feedback of the Wii balance board on the front white curtain.

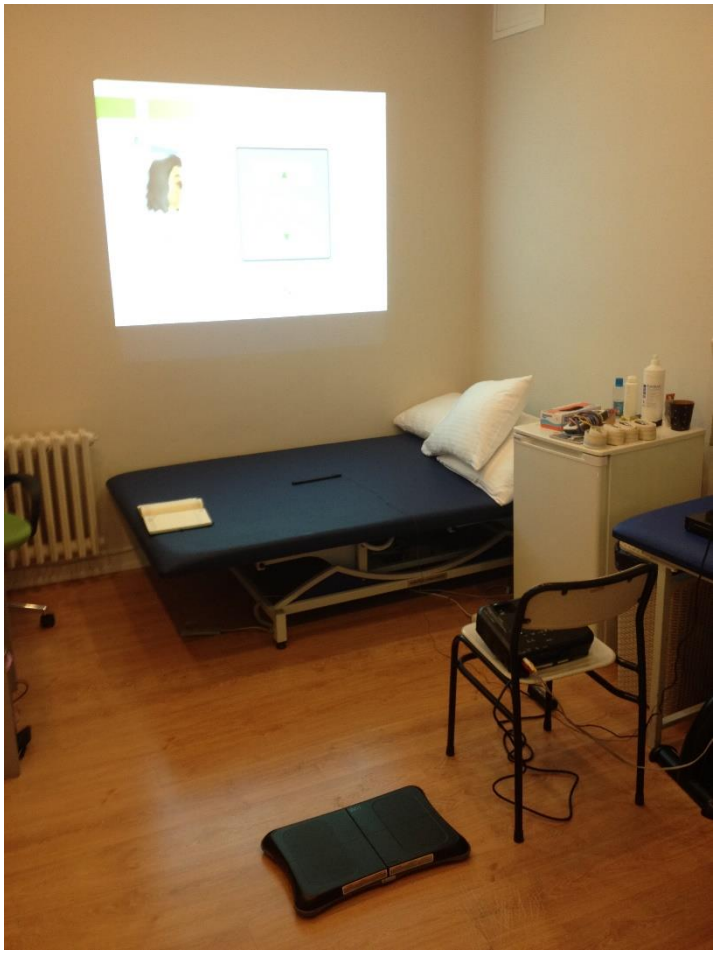

Photo 5.1. Nintento Wii

We asked all the patients to take off their shoes and get on the balance board. Patients were free to have socks on. The patients stand upright, still and relaxed with both feet separated equally and placed on the specified places indicated by the researcher. A general analysis of the body is performed when the patient is relaxed looking forward to the screen and both arms in normal position. In this section it is important that the patient should not move too much. He/she has to stand still because unsteadiness makes the analysis incorrect and the software asks the patient to stand steady and the analysis is performed again. Also the software asks for which kind of clothing the patient is wearing. We asked all the patients to take of their jacket and a slight clothing were accepted for all the cases.

At the end of this analysis the center of pressure (CoP) related to the patient is given by the device. There are for sections of which the CoP can be located by the result of the analysis:

- Front-left: section 1
- Front-right: section 2
- Back right: section 3
- Back-left: section 4

The percentage of pressure related to each foot is also shown at the end of this analysis. At this step the distribution of pressure related to each foot was documented by the researcher.

The following step was the single leg balance test. In order to test all the patients at the same situation we asked them to bring their left leg to the middle of the balance board and they were instructed to bring up their right leg as the test starts. The situation and the duration of the test was explained to the patients and all the patients were instructed to stand in a way that the right leg which is going to be brought up, should not touch the other leg or the balance board. In some patients which were susceptible to not understand the test procedure, a pretest single leg standing on the left leg was performed. The test starts with counting 3, 2, and 1. We asked the patients to bring their right leg up when they see number 1.

The whole test takes 30 seconds which the path of the feedback shown to the patients narrows as the seconds proceed and this matter makes the single leg balance more difficult. By the time the patient put his/her foot on the balance board the test stops and the standing time is recorded by the researcher. All the patients were asked to finish the 30-minutes period but no encouragement were given to them. Also the balance performance is given in percentage after the test finishes which for those who finish the 30 seconds the highest score is assigned.

There is also another parameter being gotten from the balance test which is Wii fit age.

Wii fit age is an age number related to balance scores of the individual which is calculated by all the balance performance of the patients. The Wii fit age is then compared with the real age of the patient and the difference between the Wii fit age and the real age is calculated.

After the test finishes patients can get off the balance board and put on their shoes.

5.2.1.9. Pedalo® Sensamove Balance Test

All the patient also underwent the Pedalo® Sensamove balance device test. All the patients were informed about the test duration, situation and method before the test.

The best performance was estimated to be obtained if the patient could hold the red spot at the middle of the screen which was a feedback of the balance board. The more the red spot could be held near the middle the better score would be obtained.

A laptop was used to reflect the feedback to the patient. The laptop and the Pedalo® Sensamove balance board were attached with USB cable.

Photo 5.2.2. Pedalo® Sensamove balance device

Before the patients get on the balance board, the calibration of the device was done for each patient in order to make sure that the red spot comes to the middle of the screen and the balance board is completely horizontal.

Patients were asked to take off their shoes and there feet were placed at the specific places of the round balance board indicated by the researcher. They were allowed to hold the standing bars before the test starts. This was very important because they could set their initial balance and get a confidence about the device. As the balance board is an unsteady surface, that was important that the patients rely on the balance device, therefore the initial holding the standing bars was very important and helpful and is recommended for the other researchers planning to us the Pedalo® Sensamove balance board.

The patients were informed to release their hands when the test starts and trying not to hold o use the standing bars.

Photo 5.3. Balance testing with Pedalo® Sensamove balance device

The Pedalo® Sensamove balance tests consists of three measurements.

At the first measurement the patient had no limitations but were instructed to hold the red spot at middle as much as possible. When the test finishes, the patient were allowed to take the standing bars and get ready for the second measurement.

At the second measurement there was a horizontal rectangle located at the screen which was asking the patients to limit their movement inside that rectangle. The green rectangle was becoming red in color when the patients couldn't control their balance properly and the red spot got out of the rectangle. This measurement was specifically limiting the anterior and posterior movements of the patients and therefore was measuring how much they can control their balance not to move anteriorly-posteriorly.

At the third measurement there was a vertical rectangle located at the screen which was asking the patients to limit their movement inside that rectangle. The green rectangle was becoming red in color when the patients couldn't control their balance properly and the red spot got out of the rectangle. This measurement was specifically limiting the side movements of the patients and therefore was measuring how much they can control their balance not to move laterally.

All the results of these three measurements were recorded by the researcher. The patients could get off the device after all three measurements were done.

The sample results of the three measurements of Pedalo® Sensamove balance device related to same subject is given at figure 5.2

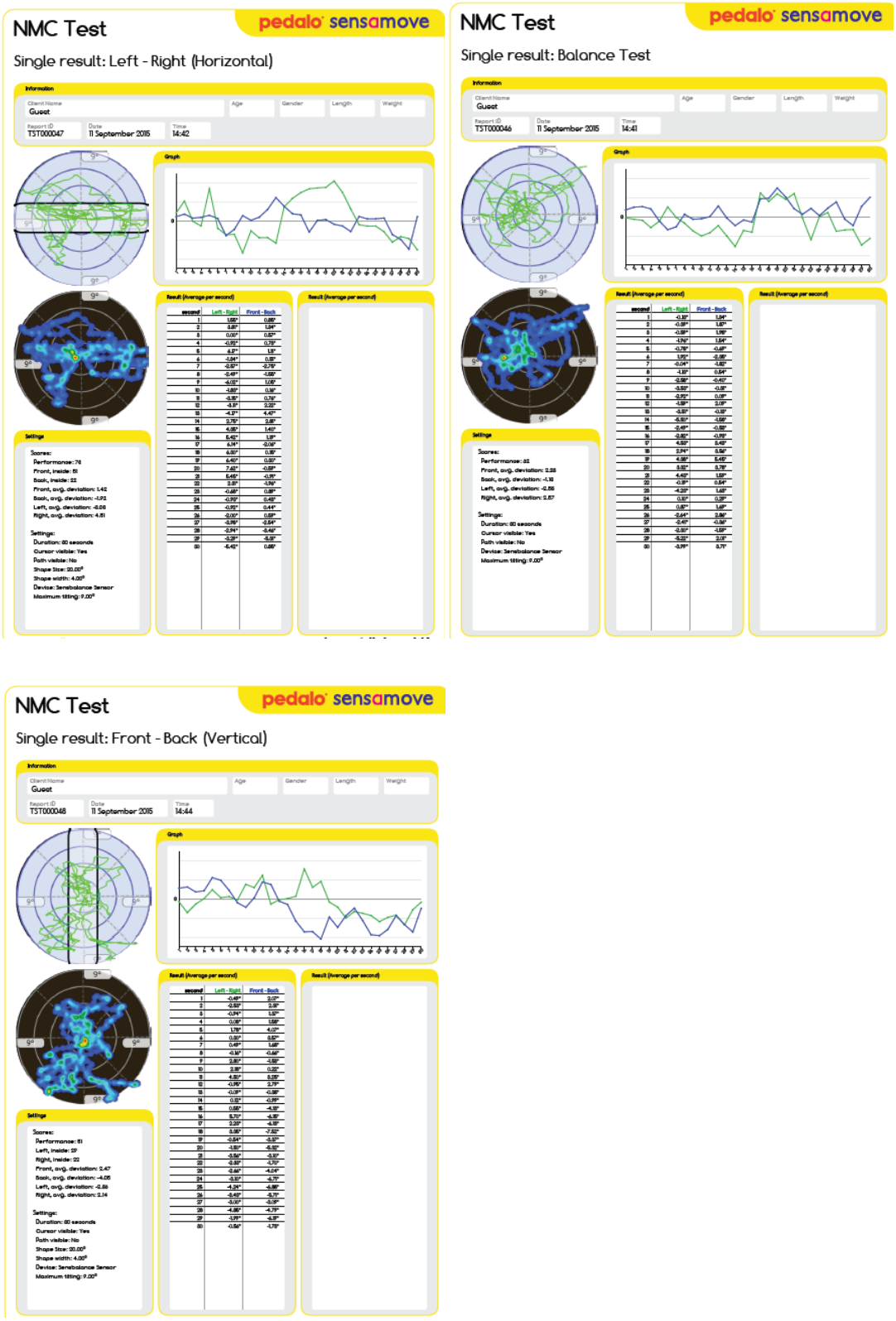

Figure 5.2 Sample results of the three measurements of Pedalo® Sensamove balance device

5.3. Statistical Analysis

Statistical analysis were performed with the SPSS (software package used for statistical analysis) program version 18.0. Data were described as mean, standard deviation and percentage. Comparisons between groups were tested with Student's-t independent method. The probability value of $P<0.05$ was considered as significant.

6. RESULTS

61 elderly people attended to our study. Patients did not have symptoms of depression. Also the cognitive performance of all the patients were acceptable. All the participants were 65 years old and elder. 31 of the participants had hypertension and 30 of them were normotensive. We name these two groups as hypertensive and normotensive groups.

6.1. Demographic Features

The average age of all participants was 73.88±9.534 with the range of 38 years old. The oldest participant was 103 years old and the youngest participant was 65 years old.

The distribution of the male and females was near to each other. The number of male participants was 29 and the number of female participants was 32. But the number of male participants inside hypertensive group was 17 and the number of female participants inside this group was 14. The number of male participants inside normotensive group was 12 and the number of female participants inside this group was 18. The distribution of males was more than females in hypertensive group and less than them in normotensive group.

Demographic information of all the participants is given in following tables.

Table 6.1 Distribution of the demographic data

	Age(year)	**Height**(m)	**Weight**(Kg)	**BMI**(Kg/m^2)
Mean	73,88	1,6231	77,336	29,2832
Standard Deviation	9.534	0,11196	15,1142	4,47267
Range	41	0,37	76,0	19,07
Minimum	65	1,42	44,0	20,93
Maximum	103	1,79	120,0	40,00

BMI: Body Mass Index

Table 6.2 Distribution of males and females inside hypertensive and normotensive groups

	Gender	**N**	**%**
Hypertensive Group	Male	17	54.8
	Female	14	45.2
	Total	31	100
Normotensive Group	Male	12	40
	Female	18	60
	Total	30	100

Table 6.3 Distribution of marital statute inside hypertensive and normotensive groups

	Marital Status	**N**	**%**
Hypertensive Group	Married	14	45.2
	Single	6	19.4
	Divorced/Widow	11	35.5
	Total	31	100
Normotensive Group	Married	25	83.3
	Single	5	16.7
	Divorced/Widow	0	0
	Total	30	100

Table 6.4 Distribution of living conditions of the participants inside hypertensive and normotensive groups

	Living Condition	**N**	**%**
Hypertensive Group	Home	13	41.9
	Nursing Home	18	58.1
	Total	31	100
Normotensive Group	Home	24	80
	Nursing Home	6	20
	Total	30	100

The normotensive participants were mostly living at their own homes and were not institutionalized. 41.9% of the hypertensive participants were living at home regarding the 58.1% of the hypertensive participants who were in the nursing home.

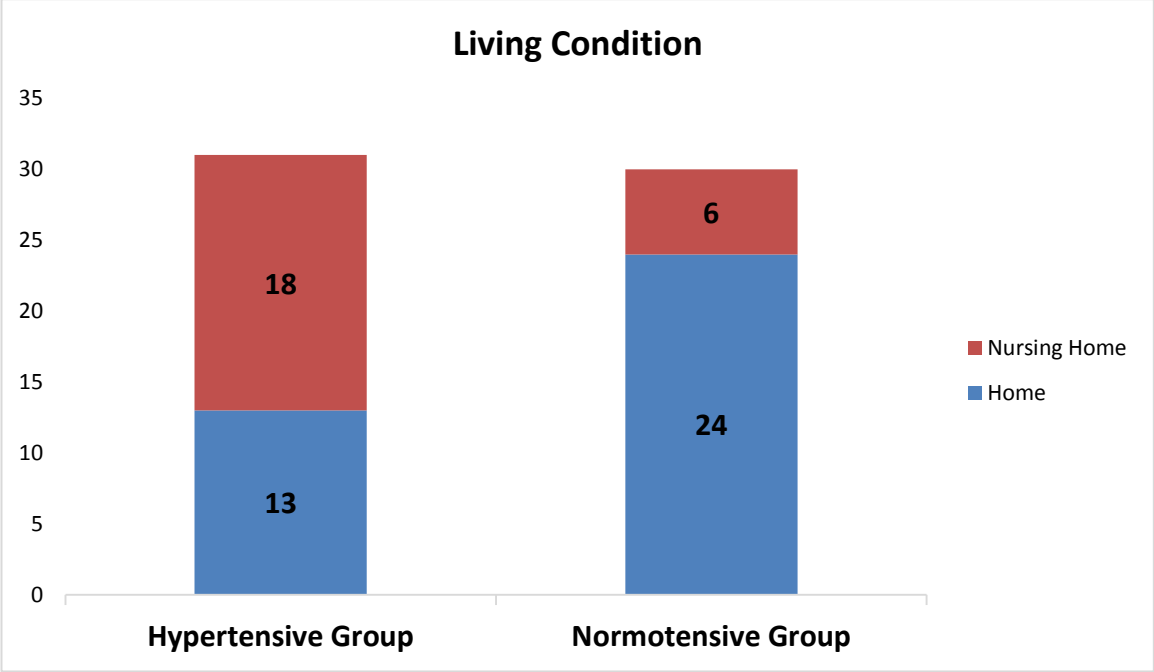

Figure 6.1. Living conditions of the participants

Most of the people living at the nursing home had hypertension (75%) while most of the participants living at their own home did not have hypertension (64.9%)

Table 6.5 Distribution of the hypertensive and normotensive participants according to their living condition.

	HT/NT	N	%
Living at home	Hypertensive	13	35.1
	Normotensive	24	64.9
	Total	37	100
Living at nursing home	Hypertensive	18	75
	Normotensive	6	25
	Total	24	100

Table 6.6 Distribution of smoking and alcohol addiction of the participants inside hypertensive and normotensive groups

	Addiction	**N**	**%**
Hypertensive Group	None	23	74.2
	Smoking	7	22.6
	Alcohol	1	3.2
	Total	31	100
Normotensive Group	None	23	76.7
	Smoking	7	23.3
	Alcohol	0	0
	Total	30	100

Table 6.7 Distribution of Educational level of the participants inside hypertensive and normotensive groups

	Educational level	**N**	**%**
Hypertensive Group	No Education	1	3.2
	Reading Writing	3	9.7
	Elementary	15	48.4
	Guidance School	4	12.9
	High School	5	16.1
	University	3	9.7
	Total	31	100
Normotensive Group	No Education	0	0
	Reading Writing	0	0
	Elementary	16	53.3
	Guidance School	5	16.7
	High School	5	16.7
	University	4	13.3
	Total	30	100

The educational level of most of the participants were elementary and below (35 out of 61). Only 7 participants out of 61 had the university educations (11.47% of all the participants).

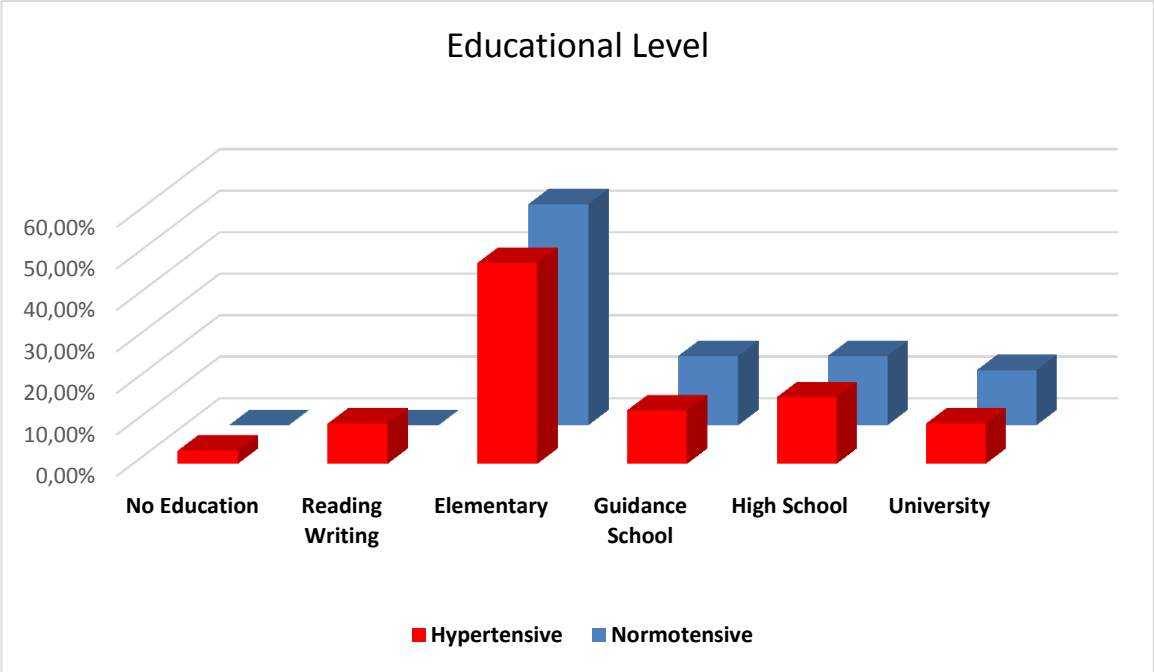

Figure 6.2. Educational level in participants

Table 6.8 History of Falling and balance problem in participants inside hypertensive and normotensive groups

	Falling Before	**N**	**%**	**Balance Problem**	**N**	**%**
Hypertensive Group	No	18	58.1	No	19	61.3
	Yes	13	41.9	Yes	12	38.7
	Total	31	100	Total	31	100
Normotensive Group	No	23	76.7	No	19	36.3
	Yes	7	23.3	Yes	11	36.7
	Total	30	100	Total	30	100

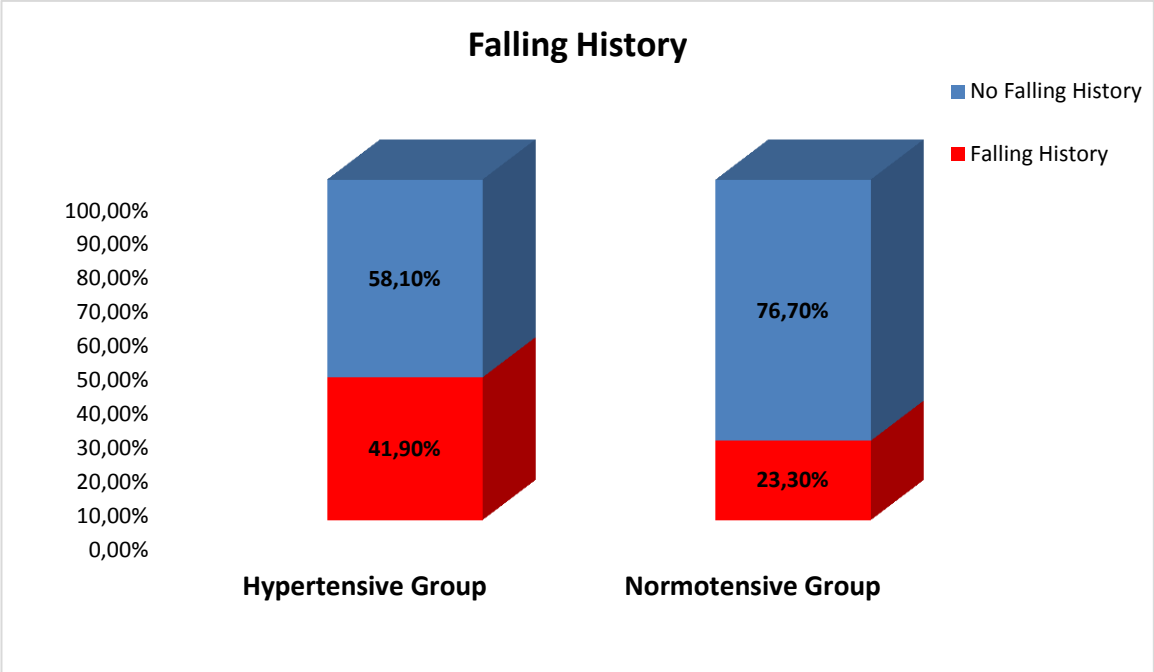

Figure 6.3. Falling history of the participants

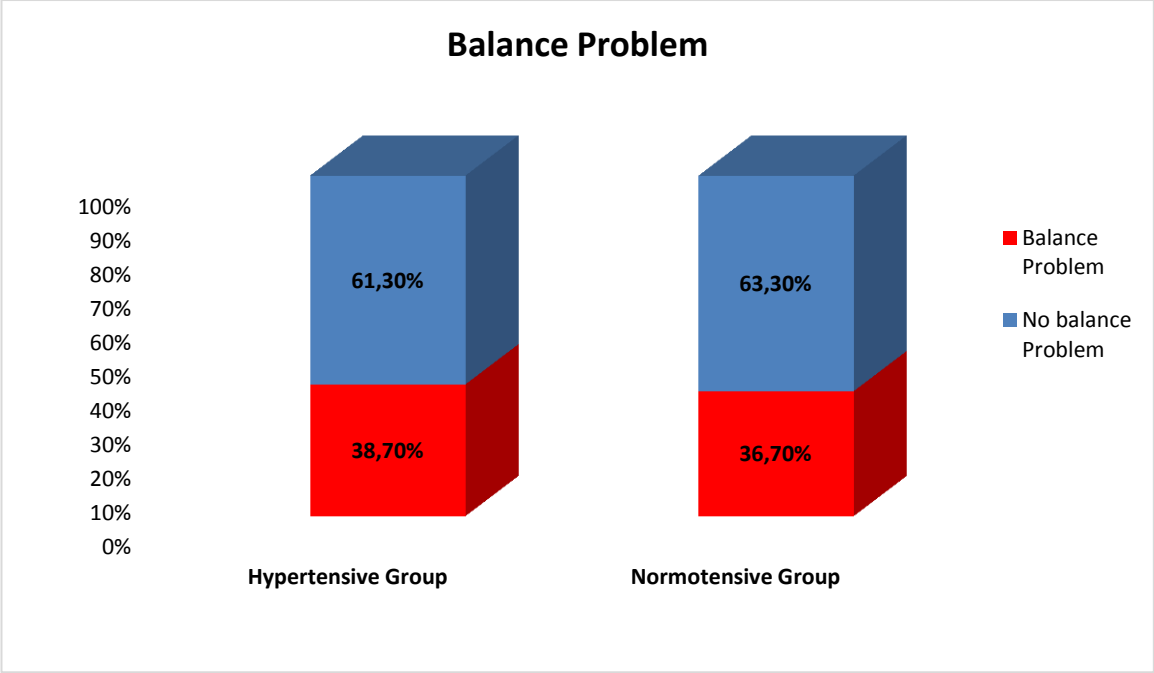

Figure 6.4. Balance problems of the participants

In order to understand the status of blood pressure in those participants having hypertension diagnosis and whether their blood pressure is under control or not, a blood pressure measurement was performed for each participant before the other evaluations. In this measurement, those with systolic blood pressure higher than 140 mm Hg assumed as having instantaneous hypertension.

Table 6.9 shows the blood pressure status before balance testing among those with and without hypertension diagnosis. All of those participants without hypertension diagnosis showed normal blood pressure at the time of testing.

61.3% of the patients having diagnosis of hypertension showed instantaneous hypertension at the time of testing and 38.7% of them had normal blood pressure at the time of testing.

Table 6.9 Instantaneous hypertension among hypertensive and normotensive groups.

	Instantaneous hypertension	**N**	**%**
Hypertensive Group	No	12	38.7
	Yes	19	61.3
	Total	31	100
Normotensive Group	No	30	100

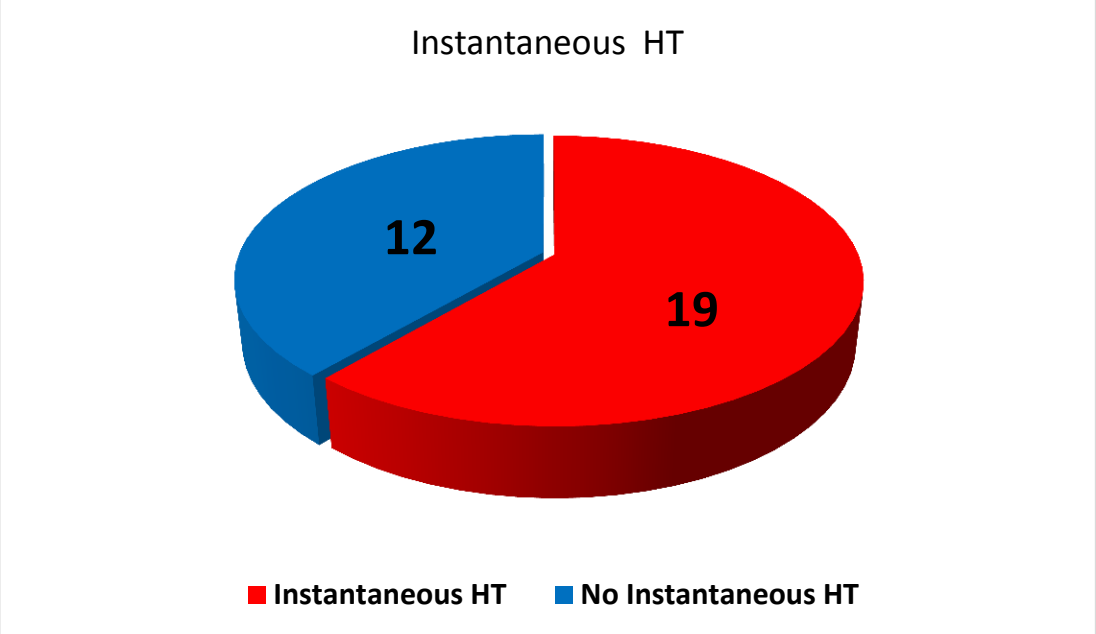

Figure 6.5. Distribution of the instantaneous hypertension

To differentiate the values of Quadriceps muscle test and ankle range of motion in hypertensive and normotensive groups, statistical comparison was performed. No statistically significant difference was found between the groups. ($p>0.05$) Table 6.10 shows the values of Quadriceps muscle test and goniometric results of ankle range of motion in both hypertensive and normotensive groups and the difference between them.

Table 6.10 Right and left Quadriceps muscle strength values, ranges of ankle dorsiflexion with statistical distribution and comparison with t-Test.

		N	**Mean±SD**	p
Right Quadriceps	Hypertensive	31	11,690±3,3477	0,60
	Normotensive	30	13,297±3,1845	
Left Quadriceps	Hypertensive	31	11,968±3,2637	0,139
	Normotensive	30	13,197±3,1362	
Right Dorsiflexion	Hypertensive	31	9,09±13,306	0,318
	Normotensive	30	11,77±5,981	
Left Dorsiflexion	Hypertensive	31	7,93±13,737	0,201
	Normotensive	30	11,42±5,600	

SD: Standard Deviation

To determine the difference between age, height, weight and Body Mass Index (BMI) of the participants inside both groups, statistical test was performed separately in both hypertensive and normotensive groups.

There was no statistically significant difference between age, height, weight and BMI of the participants of both groups. Hypertension found to be independent to age, height, weight and BMI in both groups of our study and participants of both groups were generally similar from age, height, weight and BMI points of view.

Table 6.11 Statistical difference in age, height, weight and BMI between hypertensive and normotensive groups

	Hypertensive	**Normotensive**	**p**
	Mean±SD		
Age	76,65±9,240	70,93±9,206	0,000
Height	1,6239±0,10794	1,6223±0,11782	0,000
Weight	76,726±16,3319	77,967±13,9963	0,000
BMI	28,9391±4,71921	29,6387±4,25359	0,000

SD: Standard Deviation

For comparing the results of KATZ BADL scale, SMMT and GDS in both hypertensive and normotensive groups, statistical test was performed. While there was a little difference between results of SMMT (p=0.012), no significantly difference was found in KATZ and GDS among both groups (p>0.05). All the participants had actually similar activity level, cognitive and psychological status.

Table 6.12 Statistical comparison of scores of KATZ BADL, MMSE, and GDS in both of the hypertensive and normotensive groups.

		N	**Mean±SD**	**p**
BADL	Hypertensive	31	17,45±0,995	0,235
	Normotensive	30	17,73±0,828	
MMSE	Hypertensive	31	27,87±2,125	0,012
	Normotensive	30	29,10±1,494	
GDS	Hypertensive	31	6,48±2,204	0,052
	Normotensive	30	5,23±2,700	

BADL: Basic Activities of Daily Living, MMSE: Mini Mental State Examination, GDS: Geriatric Depression Scale, SD: Standard Deviation

6.3. Results related to Balance

We compared the performance of "Timed UP and Go" test between two hypertensive and normotensive groups in order to find out if there is any relation between hypertension and TUG. A statistically significant difference was found between two groups and hypertensive group had higher completion times in TUG test (p=0.030). Hypertensive patients needed much time to complete the TUG test. The results are shown at Table 6.13.

Table 6.13 Difference between TUG and Hypertension

		N	Mean(S)±SD	p
TUG(s)	Hypertensive	31	17,37±10,06	0,030
	Normotensive	30	12,62±6,11	

TUG: Timed Up and Go Test, SD: Standard Deviation

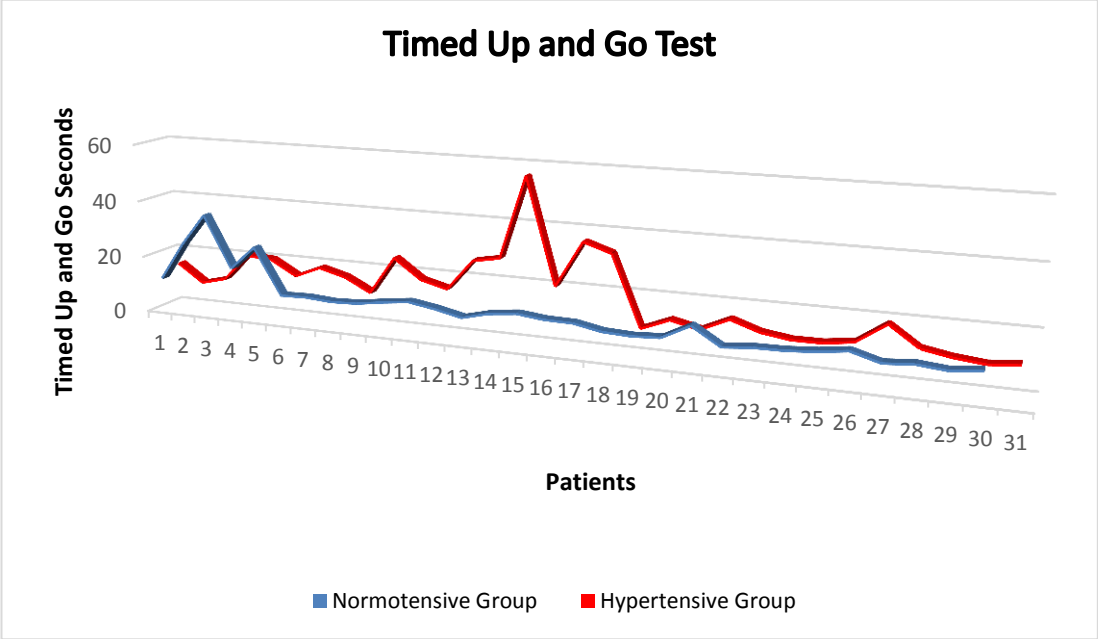

Figure 6.6. Results of Timed Up and Go Test in Hypertensive and Normotensive Groups

During the assessment of the elderly participants with Pedalo sensamove Balance device, the following parameters were taken into consideration:

Performance(%), Front Average Deviation(F Ave Dev), Back Average Deviation(B Ave Dev), Left Average Deviation(L Ave Dev), Right Average Deviation(R Ave

Dev), Horizontal Performance(H Performance) and Vertical Performance(V Performance). To compare the difference between these parameters , t-Test was used. There was no statistically significant difference in parameters of Pedalo between hypertensive and normotensive groups ($p>0.05$). Table 6.14 shows the parameters of Pedalo balance device compared in both hypertensive and normotensive group.

Table 6.14 Difference in balance parameters of Pedalo Device between hypertensive and normotensive groups.

Pedalo Balance Parameters	**Groups**	**N**	**Mean**	**p**
Performance %	Hypertensive	31	59,29±16,285	0,229
	Normotensive	30	63,97±13,59	
F Ave Dev	Hypertensive	31	2,49±1,39	0,611
	Normotensive	30	2,33±0,99	
B Ave Dev	Hypertensive	31	-1,51±0,94	0,332
	Normotensive	30	-1,761±0,99	
L Ave Dev	Hypertensive	31	-2,03±0,96	0,593
	Normotensive	30	-1,90±0,93	
R Ave Dev	Hypertensive	31	1,98±1,16	0,401
	Normotensive	30	1,76±0,91	
H Performance %	Hypertensive	31	61,74±17,08	0,118
	Normotensive	30	68,57±16,54	
V Performance %	Hypertensive	31	65,71±18,20	0,429
	Normotensive	30	69,07±14,39	

F Ave Dev: Front Average Deviation, B Ave Dev: Back Average Deviation,
L Ave Dev: Left Average Deviation, R Ave Dev: Right Average Deviation,
H Performance: Horizontal Performance, V Performance: Vertical Performance

Parameters of Nintendo Wii balance board to be compared between participants of hypertensive and normotensive groups were as following:

- Distribution of body weight to the Right foot (indicated by Wii R)
- Distribution of body weight to the Left foot (indicated by Wii L)
- Completed seconds in Wii Single Leg Balance Test (indicated by SLB Sec)
- Performance score in Wii Single Leg Balance Test (indicated by SLB performance %)
- Wii Fit age

To compare these parameters in both participants of hypertensive and normotensive groups, t-Test was used. While no statistically significant difference was found in "Distribution of body weight to the Right foot" and "Distribution of body weight to the Left foot" ($p>0.05$), parameters of "Completed seconds in Wii Single Leg Balance Test", "Performance score in Wii Single Leg Balance Test" and "Wii Fit Age" between both groups was determined significant in the statistical analysis ($P<0.05$). Data related to Nintendo Wii balance scores, mean values, standard deviation and p values are shown in Table 6.15

Table 6.15. Difference between balance parameters of Nintendo Wii Balance board in Hypertensive and Normotensive groups

		N	**Mean±SD**	**P**
Wii R	Hypertensive	31	51,0097±7,15469	0,431
	Normotensive	30	49,8067±4,29610	
Wii L	Hypertensive	31	48,6355±7,13436	0,309
	Normotensive	30	50,1900±4,29389	
SLB Sec	Hypertensive	31	14,1306±9,89863	0,001
	Normotensive	30	22,6217±9,93210	
SLB Performance %	Hypertensive	31	18,30±20,316	0,000
	Normotensive	30	42,87±24,609	
Wii Fit Age	Hypertensive	31	72,97±18,198	0,002
	Normotensive	30	58,87±15,986	

Wii R: Wii Right, Wii L: Wii Left, SLB Sec: Single Leg Balance Seconds, SLB Performance: Single Leg Balance Performance, SD: Standard Deviation

As the scores of Pedalo Balance Device were all statistically meaningless, the later analyses are all done only by the Nintendo Wii balance board results and TUG.

For analyzing if there is any relationship between falling history and balance performance t-Test was used for comparing the data.

The results of Nintendo Wii Balance board and TUG and the statistical comparison of these parameters between two groups are given at Table 6.16

After statistical analysis the results showed that among those participants who had a history of falling, there was no significant difference in balance performance ($p>0.05$ in all parameters). Participants with having a history of falling presented the same balance performance in both hypertensive and normotensive group. Therefore by having a history of falling balance performance found to be independent to hypertension.

Statistical analysis also showed that among those participants who had not a history of falling before, Wii R and Wii L was not significantly different. However hypertensive participants who had not a history of falling showed different performances in TUG, Nintendo Wii parameters compared to normotensive participants. Although having not a history of falling, hypertensive group had longer time duration in TUG, and worse performance in Nintendo Wii Balance board (except Wii R and Wii L). There was a significant statistical difference in TUG, Wii SLB Sec, Wii SLB Performance % and Wii Fit Age between hypertensive and normotensive group which are given at Table 6.16.

Table 6.16 Difference between balance performance in hypertensive and normotensive groups regarding their falling history

History of Falling			N	Mean±SD	P
NO	TUG	Hypertensive	18	15,1394±6,86159	0,016
		Normotensive	23	10,7291±2,09588	
	Wii R	Hypertensive	18	50,6556±5,27360	0,408
		Normotensive	23	49,4261±4,14293	
	Wii L	Hypertensive	18	49,3444±5,27360	0,408
		Normotensive	23	50,5739±4,14293	
	SLB Sec	Hypertensive	18	14,2550±10,35325	0,001
		Normotensive	23	25,2943±7,73069	
	SLB Performance %	Hypertensive	18	17,58±19,306	0,000
		Normotensive	23	50,23±19,810	
	WFA	Hypertensive	18	70,67±22,326	0,010
		Normotensive	23	55,48±13,399	
Yes	TUG	Hypertensive	13	20,4715±12,98945	0,777
		Normotensive	7	18,8357±10,29251	
	Wii R	Hypertensive	13	51,5000±9,38758	0,909
		Normotensive	7	51,0571±4,88803	
	Wii L	Hypertensive	13	47,6538±9,27637	0,740
		Normotensive	7	48,9286±4,87433	
	SLB Sec	Hypertensive	13	13,9585±9,64623	0,981
		Normotensive	7	13,8400±11,84507	
	SLB Performance %	Hypertensive	13	19,31±22,403	0,957
		Normotensive	7	18,71±24,493	
	WFA	Hypertensive	13	76,15±10,139	0,462
		Normotensive	7	70,00±19,706	

TUG: Timed Up and GO Test, Wii R: Wii Right, Wii L: Wii Left, SLB Sec: Single Leg Balance Seconds, SLB Performance: Single Leg Balance Performance, WFA: Wii Fit Age, SD: Standard Deviation

The last analysis is related to comparing the balance performance regarding the instantaneous hypertension. The results of statistical t-Test is given in Table 6.17. By splitting the participants into those having instantaneous hypertension and those without instantaneous hypertension we searched for the differences in TUG, Wii R, Wii L, SLB Sec, SLB Performance % and Wii fit age between these groups (one group with instantaneous hypertension and one group without instantaneous hypertension).

While there was no significant difference in TUG, Wii R, Wii L and Wii fit Age ($p>0.05$), the results of "Wii SLB Sec" and "Wii SLB Performance %" found to be statistically significant($p<0.05$). There was no difference in TUG, Wii R, Wii L and Wii fit Age if there were instantaneous hypertension or not.

The participants with instantaneous hypertension had worse balance performance in "Wii SLB Sec" and "Wii SLB Performance %". These participant stood fewer seconds on the Wii balance board and their Wii balance performance was worse than those without instantaneous hypertension.

Table 6.17 Difference between Balance performance in Hypertensive and Normotensive groups regarding their Instantaneous Hypertension

	Instantaneous Hypertension	**N**	**Mean**	**P**
TUG	NO	42	13,5131±6,11195	0,109
	YES	19	18,4058±12,07514	
Wii R	NO	42	50,3548±4,48135	0,922
	YES	19	50,5579±8,39665	
Wii L	NO	42	49,4286±4,47150	0,965
	YES	19	49,3368±8,42821	
SLB Sec	NO	42	20,5245±10,75067	0,015
	YES	19	13,4037±9,12089	
SLB Performance %	NO	42	36,05±25,412	0,009
	YES	19	17,86±21,528	
WFA	NO	42	63,74±17,108	0,150
	YES	19	71,11±20,639	

TUG: Timed Up and GO Test, Wii R: Wii Right, Wii L: Wii Left, SLB Sec: Single Leg Balance Seconds, SLB Performance: Single Leg Balance Performance, WFA: Wii Fit Age, SD: Standard Deviation

7. DISCUSSION

Because of the high incidence of falling, balance disorders and also hypertension among elderly population, this thesis was planned to understand the relationship between the balance performance of the elderly people and their hypertension. As falling causes some irreversible damages to the elderly people considering their balance needs significant attention. Our hypothesis was that if there is a relationship between balance performance of the elderly people and their hypertension, both of these health problems could be taken into consideration and regularly controlling the hypertension and balance performance of the elderly people could provide them with better quality of life.

There are different studies in the literature that shows the prevalence of hypertension and associated risk factors. Erem et al (43) have done a research to investigate this prevalence among Turkish adults. They have studied 4809 people in 9 different cities in Turkey and have looked for the differences and prevalence of hypertension related to (age, sex, obesity, marital status, reproductive history in women and level of education). 46.1% of the women and 41.6% of the men have been found to be hypertensive. They have found that the prevalence of hypertension increased with age, being highest in the 60 to 69 years old age group in their study (84.4%). HT has been found to be associated positively with marital status, smoking, age, male gender, BMI and negatively with level of education and physical activity (43).

The relationship between the age, gender, BMI, marital status, smoking and educational status of the participants in our study have been investigated. The values related to each of these factors were found to be very similar between both groups. The main requirement of our study was that the distribution of the subjects could be similar inside both groups.

It was one of the purpose of our study as we did not want these factors to affect our results. There was not a significant difference in the age and BMI between two groups. As a similar result to what was discussed before, the number of male gender

in our study were more in the hypertensive group and the number of female gender were more in the normotensive group.

Looking to the marital status, most of the subjects in the hypertensive group were married, and some near number to them had experienced marriage before but were single at the time of the test (divorced or missing spouse). While very interestingly there were no single individuals in the normotensive group, just a little part of the hypertensive group were single.

In the educational level, the population of the both groups was similar to each other. The lowest level of the educational level was seen in the hypertensive group while there was not any very-low educational level individual present inside the normotensive group. It can be because of the fact that by higher educational level, there is an awareness about risk factors of hypertension such as diet and physical activity and the caution is taken into consideration as people got plenty of information from different sources including internet, newspaper, television etc.

According to the smoking addiction of the participants, the subjects of both groups showed very similar results. Both groups had the same number of smokers and the same number of non-smokers. Alcohol consumption was reported in just one of the participants who was in the hypertension group. So the most of our subjects in both groups were not smokers. It can be related to the participants' living condition and their cultural attitudes. As some part of the participants were living in a nursing home, the atmosphere of that nursing home was far from smoking and did not encouraging them to smoke. Different activities were planned instead of smoking inside the nursing home to entertain the geriatric population. The other participants who were community-dwelling were obtaining such a cultural attitude that smoking was not considered a proper behavior.

Martín-Baranera et al (44) have studied the prevalence of hypertension in elderly people aged 65 and above living in the nursing home. In this study of 13,272 subjects which their mean age was 82.9, two third of the patients had hypertension. As they have reported, "The proportion of hypertensive patients receiving at least one antihypertensive medication was 69.7%" (44).

This report was supported by the results of our study. Among those who living in the nursing home, 75% of the subjects were hypertensive but among the community-dwelling people only 35.1% had a diagnosis of hypertension. It can be interpreted in this way that those living in the nursing home are encountering regular checkups and have the chance to be diagnosed if they have any health problems such as high blood pressure. While in the people dwelling in the community, there is a chance of missing somebody's hypertension despite an underlying high blood pressure. The people living in the nursing home have some daily blood pressure measurements by health professionals but the community-dwelling subjects do not check their blood pressure unless there was a health problem. In the other hand, of all the participants in our study, most of the subjects with the diagnosis of hypertension were living at the nursing home rather than home (58.1% to 41.9% respectively). Also a great majority of the subjects in our study who were known as normotensive were living at their own homes. So as discussed above, the prevalence of hypertension was found to be more in the nursing home in our study.

Guo et al (44) have studied the relationship between blood pressure and cognitive status of the elderly people. They have used the Mini-Mental State Examination (MMSE) in a 1736 people aged 75-101 years old. They have reported both the systolic and diastolic blood pressure to be positively and significantly related to baseline MMSE score. Also baseline systolic blood pressure has found to be positively and significantly related to follow-up MMSE score after 40.5 months among those who were not taking antihypertensive medications. They have reported that the risk of cognitive impairment was associated with high blood pressure only in persons who were taking antihypertensive medication at baseline. The results of this study were supporting that the uncontrolled hypertension could lead to lower cognitive function among elderly people (45).

In another review study which was done by Anson et al (46), the authors have encountered different results related to the relationship of the hypertension and cognitive functioning among elderly people. They have studied all the studies that

suggest that hypertension has a positive, negative, or no relationship upon cognitive performance. In some of the articles they have reviewed, systolic blood pressure have found to be in relationship with cognitive function and in some others diastolic blood pressure. The number of years individuals have been exposed to hypertension had been rarely investigated. As a result Anson et al., have not suggest any possibility of effect of hypertension on specific cognitive functions (46).

We have also used MMSE in our study. While there was very similar performance in MMSE between two groups of hypertensive and normotensive, there was a little statistically difference between hypertensive and normotensive subjects. As all the participants of our study were allowed to be included in the study regarding their MMSE score, unacceptable score in the MMSE was automatically leaded to exclude the participant from the study and therefore the remaining subjects had all acceptable MMSE score appropriate to the conditions of our study design. As discussed in the previous articles from the literature, hypertensive subject of our study showed somehow worse performance on the cognitive function. We think that the living condition plays a great role on this result of the MMSE. Although the years of being exposed to hypertension and antihypertensive medication is very important in effects of hypertension on cognitive function, the behavioral addictions such as cultural interests and logical activities seemed to be very affective among the subjects.

To understand the relationship between Activities of Daily Living (ADL) and hypertension, Caskie et al (47) have studied 3,046 elderly participants aged 65 and older during seven years period. They have reported that ADL significantly decreases by age and high blood pressure contributes to this matter. The development of hypertension was leading the individuals to more dependency and decrease in daily functions but it was suggested that early diagnosis or treatment of the hypertension could avoid this decline (47).

In our study the higher score in the BADL showed more dependency in doing the basic activities of daily living. The higher the score of ADL, the dependent was the

individual. The scores of subjects with and without hypertension were very close to each other so that all the participants were able to do their normal activities by themselves and without the help of others. Although some dwellings of the nursing home were getting help from the institute's staff for bathing or toileting, but this help had just a role of support and giving security feeling to the elderly habitants during their ambulation in a wet floor. Actually it was a strategy by the nursing home managers that was planned to decrease the number of probable falling by providing full security to the elderly individuals. Other than this all the participants were doing every activity dependently.

In a systematic review study of Zhanzhan et al (48), the authors have studied the relationship between hypertension and depression. The purpose of this study was to investigate the prevalence of depression in hypertensive patients. Totally they have studied 41 studies containing the total number of 30,796 subjects. They have reported the prevalence of depression in hypertensive patients as 26.8% (24.6% for male, 24.4% for female, 27.2% for hospital and 26.3 % for community) (48).

Also in another study Launay et al (49) have reported the association of depressive symptoms with recurrent falls. They have recruited 2,594 community-dwelling people and their number of recurrent falls and depression status have been recorded. The authors have then performed a systematic review to determine the recurrent fallers. As a result, 19.0% (n=494) participants were found to be recurrent fallers and abnormal result of the depression scale were more common among the recurrent fallers compared to non-recurrent fallers. Therefore the worse depression score was found to be associated with recurrent falls. This review article have showed that there is a significant relationship between depressive symptoms and recurrent falls (49).

We used Geriatric Depression Scale (GDS) to assess the depression of the including individuals. The individuals with higher scores of depression were planned to be excluded from our study. The results of the GDS were very similar to each other in both groups of hypertensive and normotensive subjects. As depressive symptoms

could affect the balance performance of the participants, all participants were actually planned to not having a depression problem which could affect their balance performance. In order to study the balance performance in the elderly people, we needed to eliminate those with balance problems related to their depressive symptoms and therefore we had a relatively homogeneous population from the psychological point of view.

Pizzigalli et al (50) have published an article about prevention of falling risk in elderly people. They have looked for the relationship between muscle strength of the lower extremity and the postural stability. They have conducted a PubMed search in order to find this relationship. They have concluded that the lower extremity muscular strength is needed for efficient postural stability during aging (50).

We had measured the strength of both quadriceps to eliminate the role of poor muscle strength on balance performance of the elderly subjects. The Quadriceps muscle strength in right and left lower extremity has been compared in both hypertensive and normotensive groups and no difference was found between the muscle strength of the subjects between two groups. The weak muscle strength was therefore not interfering with the result of our balance performance in the elderly people and all the subject were found to be in acceptable level of the lower extremity muscle strength.

The other parameters we had measured in the all subjects of the study was ankle dorsiflexion. The measurements which were done with the goniometer were then compared between all the subjects. Begg et al (51) have studied the changes in the knee and ankle joint as the people get older. They have compared the gaits of 12 healthy elderly and 12 healthy young adults with the use of PEAK Motus motion analysis system. During this analysis, the elderly people have shown reduced knee flexion and ankle plantarflexion at toe off and also reduced knee flexion during push-off and reduced ankle dorsiflexion during the swing phase related to the younger subjects. They have suggested that with reduced dorsiflexion during the

swing phase, elderly people are in the risk of hitting the toe to any obstacle and it can lead to impaired balance performance. So the sufficient range of motion in dorsiflexion is needed in the elderly people for not experiencing a balance disorder (51).

The comparison of the results of the right and left ankle dorsiflexion among hypertensive and normotensive subjects of our study revealed no significant result which meant that all the participants of our study had some similar ranges of ankle dorsiflexion. Although all the participants were over 65 years old, their ankle range of motion were not in a level that could affect the balance performance. It was also planned in our study to eliminate those participants that had limited range of dorsiflexion which was interfering balance performance.

Liao et al (52) have studied the relationship between metabolic syndrome and falls in community-dwelling elderly people. They have studied 165 community-dwelling older adults during three years. As a result, the prevalence of metabolic syndrome was higher among those having the history of falling related to those without a history of falling. One of the five components of the metabolic syndrome which is hypertension was observed to be more in those participants with the history of falling comparing to those without a history of falling. The difference between two groups was statistically significant (60.0% versus 50.0%, P=0.009). The writers have concluded that the metabolic syndrome is an independent risk factor for falls among community-dwelling elderly people and therefore should be taken into consideration (52).

In another study the relationship between blood pressure and falls has been investigated among community-dwelling people. In this study Klein et al (53) have inspected 3,544 community-dwelling people aging 60 years old and older and asked them for falls in previous three months. 1,970 of the subjects were women (median age of 70) and 1,574 of them were men (median age of 69).
As a result, high systolic and diastolic blood pressure was found to decrease the risk of falls in women. Also an increase of systolic blood pressure by 10 mmHg and of

diastolic blood pressure by 5 mmHg have been found to reduce the risk of falling by 9%. Conversely low systolic or low diastolic blood pressure in men was found to be a cause for an increased risk of falls (53).

In our study 41.9% of the participants included in the hypertensive group had a history of falling, whereas only 23.3% of the participants in the normotensive group had a history of falling, which showed that most of the participants of the normotensive (who did not have a diagnosis of hypertension) had not have a history of falling (76.7% of the normotensives).

Fujita et al (54) have studied effect of age on body sway using computerized posturography. They have included 144 individuals to their study (51 men and 93 women, between the ages of 22 and 88 years), the length of changes in the center of gravity have been measured by the posturography device Gravicorder (Anima) and has been accepted as distance of sway.
The distance of sway has been increased by increasing age and it was not related to differences in gender (54).

Abate et al (55) have conducted a study on 112 subjects (59 males and 54 females) to understand the effects of hypertension on balance which was performed by computerized posturography. All their study population were community-dwelling healthy people and were independent who needed no help in doing their daily activities. They have used BADL with KATZ scale to exclude those subjects needing help in two or more of the tasks. They have also used Center for
Epidemiologic Studies Depression Scale (CES-D) in order to evaluate the depression status of the subjects. They have also measured the systolic and diastolic blood pressure before the testing and a mean value of three measurement has been recorder. All the subjects have gone under a static posturographic test on a vertical force platform (Loran Engineering). They have recorded the displacement of the Center of Pressure (CoP). The test have been performed in three positions (feet 30 degree apart, semi tandem and tandem). For the feet 30 degree position, they have

recorded the balance behavior for 20 seconds. The results of the posturographic measurement have revealed these data: the CoP path length, the CoP velocity (mm/s); the medio-lateral sway and the anterio-posterior sway. The results of the posturographic assessment was very similar between hypertensive and normotensive elderly people and the researchers have found no difference in performance of the normotensive and hypertensive elderly subjects (55).

Our study was very similar to this study especially in the structure, population and the scales used. Actually this study was one of our leading studies which lead us design our hypothesis. We had also used BADL to assess the activities of daily living. Instead of CES-D we used Geriatric Depression Scale to define and exclude the subjects with depression. For assessing balance we looked for the front deviation, back deviation, left deviation and right deviation with both feet in 30 degree standing still on the Pedalo® Sensamove device. In this section only a performance was accessible in percentage. Also for detailed assessment of the medio-lateral sway and the anterio-posterior sway we performed the test for the second and third time limiting the test in horizontal and vertical direction.

According to the results of our test, the performance of the normotensive participants was better that hypertensive participants in all three measurements (measurement with no limitation, measurement limited to horizontal direction to record medio-lateral sways and measurement limited to vertical direction to record antero-posterior sways) but there was no statistically significant difference. Also in front, back, right and left deviations in the feet 30 degree apart position there was not any statistically significant difference. As a total, hypertensive individuals had worse performance than normotensive individuals in the Pedalo® Sensamove device balance test but this result was not proved with the statistics.
As all of the patients were continuing to their hypertension medication, it may be interpreted that the regulation of the blood pressure helped them rearrange their standing balance.

In another leading study, Algun et al (56) have compared 16 hypertensive who had a diagnosis of hypertension and receiving antihypertensive medications and 10 normotensive healthy elderly people to understand the difference between their balances. They have also used MMST in order to understand the cognitive status of the participants. They have also measured the systolic blood pressure and diastolic blood pressure before the test. Their test of balance has been performed with NeuroCom Balance Master System (NeuroCom System Version 8.1.0,NeuroCom®International Inc., USA). This system was detecting center of gravity (CoG) sway during different tasks. Their balance test had four stages (eyes open on a firm surface; eyes closed on a firm surface; eyes open on an unstable surface; eyes closed on an unstable surface). The postural balance scores of hypertensive groups have been worse than normotensive group but there was no statistically significant difference found between both groups.
Algun et al., suggested that somatosensory, visual, vestibular, musculoskeletal, and central nervous system integration of inputs from the peripheral and motor systems which were being decreased by the age, may have a more prominent effect on the postural balance that what does the hypertension (56).

In our study, we did not test the subjects in different sensory situation. All of the subjects in our study were doing the tests with their eyes open.
The test situation of the Pedalo® Sensamove balance device test was eyes open with individuals standing on an unstable surface trying to control their balance. The results of our study also did not reach a significant difference in comparing the hypertensive and normotensive group.

While none of the Pedalo® Sensamove balance device results were statistically significant being compared between hypertensive and normotensive groups, it can be suggested that the other sensory inputs were more important and effective in balance performance of the geriatric hypertensive individuals. We were also unable to control other sensory inputs which helped the individuals control their balance, therefore we think that the unsteady force plate of the Pedalo® Sensamove balance device may have had a great impact on decreasing the balance performance in both

hypertensive and normotensive groups. Because of this, all of the participants had a similar balance behavior that no statistically significant difference have been found. Shortly, we think that the balance of elderly participants was mostly affected by the unsteady force plate of the Pedalo® Sensamove balance device rather than their hypertension and balance plate was in closer center of attention according to hypertension.

We suggest that Pedalo® Sensamove balance device is better to be used in younger adults with better somatosensory and proprioceptive features. It is suggested that the balance devices like Pedalo® Sensamove balance device would better not to be used in the geriatric population, because they have difficulty getting familiar with the unsteady force plate of devices and feeling secure. The most effort of the elderly people seems to be focused on not falling and lose their standing balance rather than presenting an acceptable and better performance.

In a study of Chang et al (57), validity and reliability of Wii fit balance board has been investigated whether it can be used in assessment of balance in the elderly people. They have suggested that while clinical testing of balance with balance master system is somehow expensive, spacious and may be not affordable for every clinician and researcher, a somatosensory gaming console named Nintendo Wii which has gained its popularity in recent years could be used to assess balance. They have designed a pretest-posttest condition, and 20 young healthy adult (age 22.17±1.35 years) and 20 elderly healthy adult (age 67.32±3.43 years) without any complicated disease have been included in their study. All the subjects have gone under three tests with each of Nintendo Wii balance board and balance master system in a randomized way. No significant differences have been found in the pretest and posttest comparisons of the 3 balance tests for the Wii Fit balance board and the balance master system in the young adults and elderly people ($p > 0.05$). Therefore the performance of the participants were similar in both balance device which showed that both of the devices could reflect the current balance behavior of the individuals in a similar and trustable manner.

The authors have concluded that the Wii Fit balance board is a cost-effective gaming device that is cheap and easily portable device. The comparison of the validity of the results of the Wii Fit balance board and the balance master system showed that they both have a high degree of validity which suggested that the Wii Fit balance board could be used as an alternative to the balance master system for assessing balance. Also the reliability of Wii balance board was higher for elderly people related to the younger adults (57).

In another study Huurnink et al (58) have investigated the single-leg stance balance test with Nintendo Wii Balance Board. In a study of fourteen healthy adults aged 24-34, Wii balance board has been used to be compared with laboratory grade force platform. The participants have performed ten series of three balance tasks of single-leg stance with eyes open and closed, and single-leg stance after a short sideways hop. The results of the three balance tasks have been found similar for force plate and Wii balance board systems. The authors have concluded that Wii balance board is sufficiently accurate for quantifying center of pressure and overall amplitude and velocity during the single leg balance tests (58).

To our knowledge there are no other literature which compares the relationship between balance performance and the hypertension with the Wii balance board. As supported with the literature to be a reliable and valid device for assessing the balance in elderly people we performed Wii balance board for every participant.
In comparing the balance performance of the hypertensive and the normotensive group the distribution of the center of gravity on the right and left feet were not good parameters to be taken into consideration. There was not a significant difference in the performance of the normotensive participants with the hypertensive participants. As all the participants, either normotensives or hypertensives felt very relaxed on the balance board, and they were asked to stand very comfortable with the hands normally at the alongside, the distribution of the center of gravity between right and left leg had become similar in both groups. Regardless of their blood pressure both of the participants seemed to be able to

stand in a stable condition with both feet on the floor and all of the subjects presented somehow equal distribution of the center of gravity between the feet.

After the analysis of the center of the gravity, the participants were asked to do a single leg balance test on the Wii balance board. The whole test which took 30 seconds gave us the duration that participants could hold their balance on a single leg and also their single leg performance. As a significant statistical difference between the single leg balance seconds and single leg balance performance, our study showed that hypertensive participants had a worse performance than the normotensive participants. The hypertensive subjects could bear the single leg balance position shorter than the hypertensive subjects.

The single leg balance performance which was calculated by the right and left deviations during the standing in the single leg position also was better among normotensive subjects. Our study showed that in a test of single leg balance, hypertensive participants got lower grades that normotensive participants. It was important because the single leg balance performance was calculated by the right and left deviations of the one leg. The more weight bearing leg deviated to the right and left, the worse and lower the participant's performance was resulted. Therefore it can be driven from this result that the right and left deviations in weight bearing single leg balance is more among hypertensive participants rather than normotensive subjects. We can say that a person with hypertension is more vulnerable to fall in the case of single leg weight bearing because of his/her more right and left deviations.

Wii fit age which was calculated by the different balance performance of the individuals in the Nintendo Wii found to be better in the normotensive participants. Those participants with worse balance performance got an age older than what they really were and it meant that they were representing the balance performance of someone older than themselves. The Wii fit age equal or younger than the real age showed that the participant had demonstrated a good balance performance rather than his/her age. As a result of our study we found that hypertensive participants had a higher Wii fit age comparing to normotensive participants which showed that hypertension may push the balance performance to the older ages. It means that

having hypertension can lead the individuals to demonstrate a balance performance not appropriate to their age but to those older than themselves. This can be an effective awareness to the patients to pay attention to their hypertension and also their balance capabilities so that their demonstrating the features of on older subject than themselves can be a caution sign for them.

Hausdorff et al (59) studied 24 community-dwelling aging 65 to 90 years old healthy subjects with no report of disturbance in their walking. They have also used MMST and GDS in order to assess the cognitive and psychological status of the participants. They have divided the subjects into two groups of hypertensive and normotensive groups each containing 12 participants. They have performed different test to assess the balance performance such as Pull test, Timed Up and Go test, Gait speed, Mean stride time, Stride time CV, % Swing time, Swing time CV, Fractal scaling index of gait, Tinetti balance scale, Tinetti gait scale. The results of the Timed Up and Go test was better in the normotensive group rather than the hypertensive group. The subjects in the normotensive group could finish the Timed Up and Go test in shorter time than the hypertensives. Also the comparison of the result of Timed Up and Go test between hypertensive and normotensive group was statistically significant between two groups (P= 0.028). Concluding their study Hausdorff et al., have reported that increased blood pressure can negatively affect the balance and gait which results in increasing fall risk. They reported that performance of balance and gait significantly decreases in those adults having hypertension. "The greater the level of systolic BP, the greater the degree of balance and gait impairment." have said Hausdorff et al (59).

We reached supportive results in our study. The performance of hypertensive subjects in doing Timed Up and Go test was worse than results of normotensive subjects. The normotensive participants could finish the Timed Up and Go test period in a shorter and faster time and the difference between results of two groups was statistically significant. According to the results of our study, looking at Timed Up and Go test results we can conclude that hypertension is a factor in balance disorders and hypertension can affect gait in a negative direction.

Literature shows us that by aging, abnormalities in blood pressure homeostasis increases. This can lead to higher incidence of falling in elderly people. Studies show that the transient underperfusion of the brain leads to these fallings. "Age-related declines in baroreflex sensitivity, cerebral blood flow, and renal sodium conservation threaten normal blood pressure regulation and cerebral perfusion." Said Lipsitz LA (60). Clinical features of abnormal blood pressure homeostasis are all worsen by the hypertension, as said Lipsitz LA (60).

In an interesting study of the relationship between hypertension, orthostatic hypotension and the risk of falls among community-dwelling elderly population have been investigated by Gangavati et.al (61). It has been shown that the belief saying that decreasing and controlling the blood pressure with antihypertensive medications leads to orthostatic hypotension and therefore increases the incidence of falling, is not supported by this study. They have supported this claim by the literature that prevalence of orthostatic hypotension in people with controlled hypertension is lower than in those individuals having uncontrolled hypertension.

They have divided their study population into three groups:

a) Non-hypertensive group (BP<140 mm Hg and no intake of antihypertensive medication),
b) Controlled hypertensive group (BP<140 mm Hg and history of hypertension and antihypertensive medication),
c) Uncontrolled hypertensive group (BP>140 mm Hg).

The patients have been instructed to report their falls and record them daily by marking F (falling) or N (not falling). The study population of 722 had at least o months of follow up. They have concluded that the prevalence of orthostatic hypotension is higher in older community-dwelling adults with uncontrolled hypertension than in those with controlled hypertension. Also it is driven from their conclusion that among older community-dwelling adults, the risk of falling is higher in those with orthostatic hypotension (in one minute after standing) and uncontrolled

hypertension rather than in those with uncontrolled hypertension and no orthostatic hypotension (61).

In a similar study Hajjar (62) showed that in hypertensive individuals with no previous diagnosis and treatment of orthostatic hypotension, the use of antihypertensive medication can be safe and lead to a low risk of developing orthostatic hypotension. So without the history of hypotension, using antihypertensive medication does not affect the patient to present orthostatic hypotension (62).

We have also divided our hypertensive groups into those with controlled hypertension and those with uncontrolled hypertension. Although all the patients in the hypertension group were taking antihypertensive medication, there were some participants that showed high blood pressure at the time of testing. Participants with the instantaneous blood pressure (regarding their antihypertensive treatment) were accepted as the "uncontrolled hypertensive group" and those with a history of hypertension and regulated blood pressure were accepted as controlled hypertensive groups. None of the participants in the normotensive group showed higher blood pressure at the time of testing. 61.3 % of the hypertensive groups had also high blood pressure at the time of testing and were categorized as uncontrolled hypertensives. 38.7 % of the hypertensives were categorized as controlled hypertensives. We were therefore capable of combining the controlled hypertensive individuals with those of normotensive group. There was no relationship in the Timed Up and Go results of the controlled hypertensive and normotensive group (n=42) and uncontrolled hypertensive group (n=19). The instantaneous hypertension seemed to not affecting the time needed to completing the Timed Up and Go test. The general concept of hypertension (being hypertensive or normotensive) was more correlated with the Timed Up and Go test. It can be because of this matter that those with uncontrolled and instantaneous higher blood pressure were adopted to that higher blood pressure and maybe even not aware of their blood pressure. They may be used to this high blood pressure in their daily living and felt no need to control their blood pressure by a health care professional.

In the balance performance of Nintendo Wii balance board, there was a significant difference in single leg balance performance of the Nintendo Wii balance board regarding to instantaneous hypertension. We think that some aspects of the Wii balance board show that instantaneous hypertension worsens the single leg balance performance regardless of the underlying antihypertensive medication. It was found in our study that those subjects with uncontrolled instantaneous hypertension were showing more deviations to the right and left during the single leg balance.

The instantaneous hypertension may be the disturbing factor in the co-activation of the different muscle groups in the weight bearing foot and therefore leaded to perturbations and several deviations to the right and left, so these subjects were very unsteady during their single leg weight bearing. Also the specific brain parts controlling the balance and coordination may have been affected if the subjects stand in one leg with a high blood pressure at the time of standing. As the sensory inputs from different parts of the body is affected with the hypertension, it can be also discussed that in the presence of instantaneous hypertension all the factors come together to make the subject stand with several deviations on one leg, which makes the Wii performance decrease. The low duration of standing on the Wii balance board while having an instantaneous hypertension also can be interpreted in this way that the disorderliness of blood flow to the weight bearing foot could be the factor to improper contraction of the greater muscle groups and therefore subjects were unable to hold their position on single leg and ended the test. Also the interesting finding inspected by the researcher was that most of the participants with the instantaneous hypertension were very unfamiliar with these kind of sportive activities. It suggests that their hypertension and their way of living maybe stimulate each other. Having hypertension leaded them to decrease their physical activity to a minimum level and on the other hand a sedentary lifestyle was flaming their blood pressure. Most of the participants were very unfamiliar to this kind of very simple activity such as single leg standing and they were surprised when they could not finish the thirty second of the test duration. Putting in simple, the test looked very simple but mostly the hypertensive group were not completely successful in doing it. Further studies are needed to investigate the relationship between the instantaneous hypertension and the balance performance.

We also divided our subjects to those having a history of falling and those do not having a history of falling. We tried to find out if there is any relationship in the balance performance between the hypertensive and normotensive group. The testing parameters were Timed Up and Go test, Wii R, Wii L, SLB Sec, SLB Performance and Wii fit age.

Among those who had a history of falling there wasn't any difference between balance performance between hypertensive and normotensive participants. In can be interpreted that with experiencing a falling before, hypertension is not a matter to be taken into consideration prior to the falling history. It means that falling history comes in the first line of risk factors for falling proceeding by hypertension. If a person had experienced a falling before having high blood pressure or not is not a matter of caution. Once the subject had experienced a falling, whether they had hypertension or not, the balance got worse. It can be explained in this way that while there was a history of falling, it showed that the different factors effective in making people fall have come into action. When each of the risk factors was present at the individuals that make them fall, there wasn't any need for hypertension to disturb balance, because the other risk factors are actually enough for poor balance and therefore the presence of those risk factors did not let the hypertension to interfere with effected balance and show its presence. Falling history and hypertension seemed to exacerbate each other in the case participants have experienced a falling before.

In the other group of ours, the balance performance of the subjects without a falling history were compared between the hypertensive and normotensive group. The results of this section were similar to those of our findings without dividing the subjects into groups (falling and not falling history). While we were not expecting a meaningful difference between the performance in Wii R and Wii L, other findings showed that hypertensive individuals who did not have a history of falling had a worse balance performance than normotensive group. The time needed to complete the Timed Up and Go test was longer and the performance on Wii single leg balance seconds and finishing score (performance %) was worse and Wii fit age was older among hypertensive group. This is a precious finding that makes us think that while

there isn't any history of falling before, control of the blood pressure can be useful in elderly people. It was found in our study that even without a history of falling, the presence of hypertension could lead to bad balance behavior. Those elderly people who had not experienced a falling before but do have hypertension should take their balance, sportive and physical activity and also their controlled hypertension into direct consideration. Again we think that while there were a good signs of no risk factor for poor balance that the subjects didn't reported any falling, hypertension could do its role for disturbing balance with different mechanisms discussed before. Not experiencing any falling before, makes everybody not thinking about their balance and even not being aware of their poor balance. This matter only obligates them to pursue their hypertensive medication and not doing any physical activity, while there is an underlying poor balance performance being affected by the hypertension.

Maciaszek et al (63) have studied 27 individuals with the age of 65 to 81 years old. They have measured systolic blood pressure for all the participants. They have planned an exercise program to be done by the subjects and the systolic blood pressure has been measured before and after the workout. Then the postural sway has been assessed with the patients standing on their both feet. All the participants have undergone the postrographic measurement with the AccuGaitTM System posturographic platform (AMTI PJB-101 model, AMTI, Waterdown, MA), which has measured the center of pressure. The participants have stood barefoot on the platform with their hands being relaxed alongside the body. They were asked to stand still for 30 second or for as long as it was possible. This test has been repeated for each subject after the workout (the first test has been done before the workout). The purpose of the researchers was to increase the blood pressure value in the participants and observe the changes in their balance behavior. As a result, either elevated or lowered resting blood pressure was shown to negatively affect the levels of posturographic parameters measured after the workout. Maciaszek et al., have concluded that both increased and decreased systolic blood pressures are independent risk factors for postural stability. However lower or higher values of systolic blood pressure are related to the risk of temporary decrease in postural stability (63).

Dumurgier et al (64) have studied the relationship between hypertension and lower walking speed in the elderly people. The nearly 7 yearlong study has been performed in three cities of France including 1774 community-dwelling persons aged 65 years and older. The walking speeds have been recorded at the beginning of the study. For recording walking speed two photoelectric cells connected to a chronometer have been used in a corridor with a distance of 6 meters. Participants were asked to walk in the corridor with their maximum speed. The time needed to cover 6 meters was measured by the photoelectric cells, and walking speed was computed as 6 meters divided by time in seconds. The patients had four follow ups in which their walking speed had been recorded at the fourth follow up again. As a result the authors have said that hypertensive patients had a lower mean walking speed than normotensive individuals. Also they have reported a progressive decrease in mean walking speed with an increasing number of antihypertensive drugs used. On the other hand, Dumurgier et al., have reported that patients with hypertension had a higher mean annual decline in walking speed than normotensive individuals. The findings of this study showed that hypertension plays a role in motor decline in the elderly, partly explained by its consequences on brain vessels (64).

In another similar study, Rosano et al (65) have studied the relationship between high blood pressure and gait speed in elderly people. 2,733 have been included in their study and the whole follow up has taken 18 years. The participants were accepted as the hypertensive subjects if they had a diagnosis of hypertension before and if they were taking antihypertensive medications. The participants have been divided into four groups of normotensive, newly diagnosed hypertensive, controlled hypertension and uncontrolled hypertension. The researchers were just looking for the change in gait speed during years. Gait speed was measured as the time needed to walk 4.57 meters at normal speed beginning from a still-standing position. The results of this study over 14 years of follow-up showed that hypertension accelerated gait speed slowing in the well-functioning community-dwelling older adults. The slowing of the gait not only occurred in those with the newly diagnosed hypertension group and

uncontrolled hypertension group, but also for controlled hypertensive group (65).

It was supported with the results of our study, as in the similar test we used Timed Up and Go test to assess the elderly people's ability to perform the required condition of the test on acquired time. As the better performance was accepted if the participant could finish the test as fast as possible, hypertensive individuals presented a longer time to finish the Timed Up and Go test. The statistical analysis showed that there is a significant difference among hypertensive and normotensive group and hypertensive subjects needed more time to complete the test. As our research was not a longitudinal study, we were unable to measure the second or even third and fourth walking speed in order to understand the difference between different walking speeds during the time. Because of this, calculating that whether there is any decline in speed affected by hypertension or not needs our further testing of the same subjects.

8. CONCLUSION AND RECOMMENDATIONS

In our study of evaluation of the balance in geriatric hypertensive individuals, in order to understand the effect of high blood pressure on balance performance the following conclusions have been reached. While the results of the Pedalo® Sensamove balance device were not significant in any sup parameter, the following results will not discuss the findings related to the Pedalo® Sensamove balance device.

1- The prevalence of hypertension among elderly people is more in the nursing homes rather than the private homes.

2- Hypertensive subjects have a shorter performance in Wii Single Leg Balance seconds than the normotensive participants. Elderly individuals with hypertension can bear single leg balance position less than the normotensive individuals.

3- Subjects with hypertension have a worse score in Wii Single Leg Balance performance than the normotensive participants. Hypertensive Elderly individuals demonstrate more unsteadiness in the weight bearing foot during the single leg balance position.

4- Individuals with hypertension demonstrate a balance features related to those older than themselves according to Wii fit age. The elderly people with hypertension are not a good representative of appropriate age-related balance behavior.

5- The performance of hypertensive subjects in doing Timed Up and Go test is worse than results of normotensive subjects. The hypertensive geriatric people need longer time to finish a three meters walk compared to normotensive geriatrics.

6- The instantaneous hypertension does not affect the time needed to complete the Timed Up and Go test. The performance of elderly people with hypertension in Timed Up and Go test in independent of their instantaneous hypertension.

7- Instantaneous hypertension worsens the Nintendo Wii single leg balance performance regardless of the underlying antihypertensive medication. Elderly people with uncontrolled instantaneous hypertension show more deviations to the right and left during the single leg balance test on the Nintendo Wii balance board.

8- With experiencing a falling before, hypertension is not the leading factor to interfere the balance. Once the elderly people experience a falling, whether they have hypertension or not, the balance becomes worse. The balance performance is independent to hypertension while there is a history of falling.

9- The hypertensive geriatrics who have not a history of falling, demonstrate a worse score in the Timed Up and Go test compared to normotensive elderly people.

10- Even without a history of falling hypertensive elderly people can stand a shorter time on the Wii balance board with single leg balance position. Not having a history of falling does not guarantee the good balance among hypertensive geriatrics.

11- Not experiencing a falling before lead the normotensive geriatric people to demonstrate a better performance on the Wii single leg balance test compared to hypertensive geriatrics. For the elderly people without a history of falling but the presence of hypertension, attention to working on balance activities and physical activities is suggested.

12- The Wii fit age differs between the hypertensive and normotensive elderly people while there is not a history of falling. Regardless of no falling before, hypertensive geriatrics seem as if they are older that their real age in the balance performances.

13- Elderly hypertensive individuals need a longer time to finish the Timed Up and Go test compared to normotensive elderly subjects. A decline in walking speed is observed in the hypertensive geriatrics.

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10. APPENDİX

Appendix 1- Değerlendirme Formu

Değerlendirme Formu

- **Tarih:**
- **Ad-Soyad:**
- **Doğum Tarihi:**
- **Yaş:**

Boy:	**Kilo:**	**BMI:**

- **Medeni hali:** Evli □ Bekar □

- **Yaşam koşulu:** Yalnız□ Akraba□ Huzurevi□ Bakıcı□ Eşi□
- **Eğitim Seviyesi:** Yok □ Okur Yazar □ İlkokul□ Orta □ Lise □ Üniversite□
- **Alışkanlık:** Sigara□ Alkol□

- **Mobilite Durumu:** Yatağa bağımlı□ Mobil□
- **Daha önce düştünüz mü?**
- **Dengeniz bozulur mu?**

- **Kullandığınız ilaç sayısı:**

Appendix 2. BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU

Aşağıda bu araştırma ile ilgili detaylı bilgiler yer almaktadır, lütfen dikkatli bir şekilde tümünü okuyunuz.

ÇALIŞMAMIZ NEDİR?
Bu çalışmanın amacı hipertansif geriatrik bireylerin denge durumunu incelemektir.

ÇALIŞMANIN AMACI NEDİR?
Geriatrik bireylerde düşmeyi engellemek her zaman değerlendirme ve tedavinin ön planında yer almaktadır. Hipertansif geriatrik bireylerin yürüme hızının azalması ve anatomik ve fizyolojik sebepler yüzünden düşmeye daha çok meyilli oldukları görülmüştür.

Bu çalışmanın amacı hipertansif geriatrik bireylerin denge durumunu araştırmaktır.

NASIL BİR UYGULAMA YAPILACAKTIR?
Hekim tarafından muayene edilip hipertansiyon tanısı konulduktan sonra fizyoterapist tarafından ilgili değerlendirmeler yapılacaktır.

SORUMLULUKLARIM NEDİR?
Araştırmamıza dahil olan hastaların değerlendirmelere uyum göstermeleri beklenmektedir. Bu koşullara uyulmadığı takdirde araştırıcı sizi program dışı bırakabilme yetkisine sahiptir.

ARAŞTIRMANIN DENEYSEL KISIMLARI
Araştırmamız deneysel bir çalışma değildir.

ÇALIŞMAYA KATILMA İLE BEKLENEN OLASI RİSKLER VEYA RAHATSIZLIKLAR NEDİR?
Bu çalışmada uygulanacak olan tedavi yaklaşımları hiçbir şekilde risk taşımamaktadır ve size rahatsızlık verecek herhangi bir etki yoktur. Ayrıca, beklenen yarar elde edilemediği durumlarda bunun nedenleri hakkında size gereken açıklama yapılacaktır.

KATILIMCILARIN ÇALIŞMAYA DAHİL OLMASI
Çalışmaya kendi rızanızla katılacaksınız veya çalışmaya katılmayı reddedebilecek ve isteğinizle hiçbir yaptırıma uğramaksızın çalışmadan ayrılabileceksiniz.

İLETİŞİM
Hasta veya yasal temsilcilerin araştırma hakkında veya araştırma ile ilgili herhangi bir terslik olduğunda iletişim kurabileceğiniz kişi ve telefon numarası aşağıda verilmiştir:
Fzt. Farzin Hajebrahimi **0**(216) 681 51 00-5645

ÇALIŞMANIN SÜRESİ

Araştırmaya
2 saat süreyle katılacaksınız.

BİLGİLERİM KONUSUNDA GİZLİLİK SAĞLANABİLECEK MİDİR?
Size ait tüm tıbbi ve kimlik bilgileriniz gizli tutulacaktır ve araştırma yayınlansa bile kimlik bilgileriniz verilmeyecektir ancak araştırmanın sorumluları etik kurullar ve resmi makamlar gerektiğinde tıbbi bilgilerinize ulaşabilir. Siz de istediğinizde kendinize ait tıbbi bilgilere ulaşabilirsiniz.

Çalışmaya Katılma Onayı

"Bilgilendirilmiş Gönüllü Olur Formu"ndaki tüm açıklamaları okudum. Bana yukarıda konusu ve amacı belirtilen araştırma ile ilgili yazılı ve sözlü açıklama aşağıda adı belirtilen fizyoterapist tarafından yapıldı. Aklıma gelen tüm soruları araştırıcıya sordum, yazılı ve sözlü olarak bana yapılan tüm açıklamaları ayrıntılarıyla anlamış bulunmaktayım. Araştırmaya gönüllü olarak katıldığımı, istediğim zaman gerekçeli olarak veya gerekçe göstermeden araştırmadan ayrılabileceğimi biliyorum. Bu araştırmaya hiçbir baskı ve zorlama olmaksızın kendi rızamla katılmayı kabul ediyorum.

Bu formun imzalı ve tarihli bir kopyası bana verildi.

GÖNÜLLÜNÜN		**İMZASI**
ADI & SOYADI		
ADRESİ		
TEL.		
TARİH		

AÇIKLAMALARI YAPAN ARAŞTIRICININ		**İMZASI**
ADI & SOYADI		
TARİH		
HASTANIN YASAL TEMSİLCİSİNİN (EĞER GEREKLİYSE)		**İMZASI**

ADI & SOYADI		
YAKINLIK DERECESİ		
TARİH		
RIZA ALMA İŞLEMİNE BAŞINDAN SONUNA KADAR TANIKLIK EDEN KİŞİNİN (EĞER VARSA)		**İMZASI**
ADI & SOYADI		
TARİH		

Appendix 3. Kullanılan Skalalar

KATZ 1970 - BADL

1. Yıkanma Duş alma, küvette yıkanma	
Kendi başıma yıkanamıyorum	**Bağımlı (1)**
Kendi başıma yıkanırken yardım alıyorum	**Kısmen bağımlı (2)**
Kendi başıma yıkanabiliyorum	**Bağımsız (3)**

2. Giyinme Çekmece veya dolaptan gerekli tüm kıyafetleri alabilmek ve bunları uygun şekilde giyebilmek	
Kendi başıma giyinemiyorum	**Bağımlı (1)**
Kendi başıma giyinirken yardım alıyorum	**Kısmen bağımlı (2)**
Kendi başıma giyinebiliyorum	**Bağımsız (3)**

3. Tuvalet İhtiyacı Tuvalete gitmek ihtiyacını giderdikten sonra temizliğini yapabilmek ve kıyafetini düzeltebilmek	
Tuvalet ihtiyacımı karşılayamıyorum	**Bağımlı (1)**
Tuvalet ihtiyacımı karşılarken yardım alıyorum	**Kısmen bağımlı (2)**
Tuvalet ihtiyacımı karşılayabiliyorum (baston walker veya tekerlekli sandalye kullanılabilir gece sürgü veya ördek kullanıp sabah bunların temizliğini yapabilir.)	**Bağımsız (3)**

4. Transfer/Geçişler Yatağa girip çıkmak, sandalyeye oturmak kalkmak vb. işler	
Bu tarz işlevleri yapamıyorum	**Bağımlı (1)**
Bu tarz işlevleri yaparken yardım alıyorum	**Kısmen bağımlı (2)**
Bu tarz işlevleri yapabiliyorum	**Bağımsız (3)**

5. Kontinans/Boşaltım Büyük ve Küçük abdest boşaltımını kontrol edebilmek	
Mesane ve bağırsak boşaltımımı haftada üçten fazla 'kaza' oluyor	**Bağımlı (1)**
Mesane ve bağırsak boşaltımımı haftada bir veya iki 'kaza' oluyor	**Kısmen bağımlı (2)**
Mesane ve bağırsak boşaltımımı kontrol edebiliyorum	**Bağımsız (3)**

6.Beslenme Yemeği kaptan alıp ağıza götürmek	
Yemeğimi kendi başıma yiyemiyorum	**Bağımlı (1)**
Yemeğimi yerken yardım alıyorum	**Kısmen bağımlı (2)**
Yemeğimi kendi başıma yiyebiliyorum	**Bağımsız (3)**

Appendix 4. Geriatrik Depresyon Skalası

Lütfen yaşamınızın son bir haftasında kendinizi nasıl hissettiğinize ilişkin aşağıdaki soruları kendiniz için uygun olan yanıtı işaretleyerek yanıtlayınız.

	Evet	Hayır
1) Yaşamınızdan temelde memnun musunuz?	☐	☐
2) Kişisel etkinlik ve ilgi alanlarınızın çoğunu halen sürdürüyor musunuz?	☐	☐
3) Yaşamınızın bomboş olduğunu hissediyor musunuz?	☐	☐
4) Sık sık canınız sıkılır mı?	☐	☐
5) Gelecekten umutsuz musunuz?	☐	☐
6) Kafanızdan atamadığınız düşünceler nedeniyle rahatsızlık duyduğunuz olur mu?	☐	☐
7) Genellikle keyfiniz yerinde midir?	☐	☐
8) Başınıza kötü bir şey geleceğinden korkuyor musunuz?	☐	☐
9) Çoğunlukla kendinizi mutlu hissediyor musunuz?	☐	☐
10) Sık sık kendinizi çaresiz hissediyor musunuz?	☐	☐
11) Sık sık huzursuz ve yerinde duramayan biri olur musunuz?	☐	☐
12) Dışarıya çıkıp yeni bir şeyler yapmaktansa, evde kalmayı tercih eder misiniz?	☐	☐
13) Sıklıkla gelecekten endişe duyuyor musunuz?	☐	☐
14) Hafızanızın çoğu kişiden daha zayıf olduğunu hissediyor musunuz?	☐	☐
15) Sizce şu anda yaşıyor olmak çok güzel bir şey midir?	☐	☐
16) Kendinizi sıklıkla kederli ve hüzünlü hissediyor musunuz?	☐	☐
17) Kendinizi şu andaki halinizle değersiz hissediyor musunuz?	☐	☐
18) Geçmişle ilgili olarak çokça üzülüyor musunuz?	☐	☐
19) Yaşamı zevk ve heyecan verici buluyor musunuz?	☐	☐
20) Yeni projelere başlamak sizin için zor mudur?	☐	☐
21) Kendinizi enerji dolu hissediyor musunuz?	☐	☐
22) Çözümsüz bir durum içinde bulunduğunuzu düşünüyor musunuz?	☐	☐
23) Çoğu kişinin sizden daha iyi durumda olduğunu düşünüyor musunuz?	☐	☐
24) Sık sık küçük şeylerden dolayı üzülür müsünüz?	☐	☐
25) Sık sık kendinizi ağlayacakmış gibi hisseder misiniz?	☐	☐
26) Dikkatinizi toplamakta güçlük çekiyor musunuz?	☐	☐
27) Sabahları güne başlamak hoşunuza gidiyor mu?	☐	☐
28) Sosyal toplantılara katılmaktan kaçınır mısınız?	☐	☐
29) Karar vermek sizin için kolay oluyor mu?	☐	☐
30) Zihniniz eskiden olduğu kadar berrak mıdır?	☐	☐

Appendix 5. Standardized Mini Mental Test

Ad Soyad: **Tarih:** **Yaş:**
Eğitim (yıl): **Meslek:** **Aktif El:**
T. Puan:

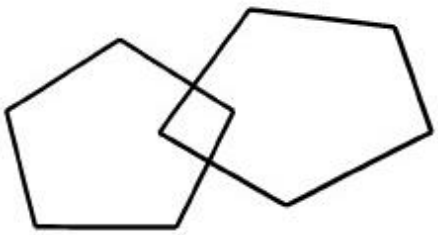
YÖNELİM (Toplam puan 10)
Hangi yıl içindeyiz..... ( )
Hangi mevsimdeyiz ..... ( )
Hangi aydayız ..... ( )
Bu gün ayın kaçı ..... ( )
Hangi gündeyiz ..... ( )

Hangi ülkede yaşıyoruz ..... ( )
Şu an hangi şehirde bulunmaktasınız ..... ( )
Şu an bulunduğunuz semt neresidir ..... ( )
Şu an bulunduğunuz bina neresidir ..... ( )
Şu an bu binada kaçıncı kattasınız ..... ( )

KAYIT HAFIZASI (Toplam puan 3)
Size birazdan söyleyeceğim üç ismi dikkatlice dinleyip ben bitirdikten sonra tekrarlayın
(Masa, Bayrak, Elbise) (20 sn süre tanınır) Her doğru isim 1 puan ..... ( )
DİKKAT ve HESAP YAPMA (Toplam puan 5)
100'den geriye doğru 7 çıkartarak gidin. Dur deyinceye kadar devam edin.
Her doğru işlem 1 puan. (100, 93, 86, 79, 72, 65) ..... ( )

HATIRLAMA (Toplam puan 3)
Yukarıda tekrar ettiğiniz kelimeleri hatırlıyor musunuz? Hatırladıklarınızı söyleyin.
(Masa, Bayrak, Elbise)..... ( )

LİSAN (Toplam puan 9)
a) Bu gördüğünüz nesnelerin isimleri nedir? (saat, kalem) 2 puan (20 sn tut)
..... ( )
b) Şimdi size söyleyeceğim cümleyi dikkatle dinleyin ve ben bitirdikten sonra tekrar
edin. "Eğer ve fakat istemiyorum" (10 sn tut) 1 puan..... ( )
c) Şimdi sizden bir şey yapmanızı isteyeceğim, beni dikkatle dinleyin ve söylediğimi
yapın. "Masada duran kağıdı sağ/sol elinizle alın, iki elinizle ikiye katlayın ve yere
bırakın lütfen" Toplam puan 3, süre 30 sn, her bir doğru işlem 1 puan..... ( )
d) Şimdi size bir cümle vereceğim. Okuyun ve yazıda söylenen şeyi yapın. (1 puan)
"GÖZLERİNİZİ KAPATIN" (arka sayfada)..... ( )
e) Şimdi vereceğim kağıda aklınıza gelen anlamlı bir cümleyi yazın (1 puan)..... ( )
f) Size göstereceğim şeklin aynısını çizin. (arka sayfada) (1 puan) ..... ( )



11. APPROVAL OF ETHICAL COMMITTEE

İSTANBUL MEDİPOL ÜNİVERSİTESİ GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU KARAR FORMU

BAŞVURU BİLGİLERİ	ARAŞTIRMANIN AÇIK ADI	Hipertansif Geriatrik Bireylerdeki Dengenin Değerlendirilmesi			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACI UNVANI/ADI/SOYADI	Farzin Hajebrahimi			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ UZMANLIK ALANI	Fizyoterapi ve Rehabilitasyon			
	KOORDİNATÖR/SORUMLU ARAŞTIRMACININ BULUNDUĞU MERKEZ	İstanbul			
	DESTEKLEYİCİ	-			
	ARAŞTIRMAYA KATILAN MERKEZLER	TEK MERKEZ ☐	ÇOK MERKEZLİ ☒	ULUSAL ☒	ULUSLARARASI ☐

İSTANBUL MEDİPOL ÜNİVERSİTESİ GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU KARAR FORMU

	Belge Adı	Tarihi	Versiyon Numarası	Dili
Değerlendirilen Belgeler	ARAŞTIRMA PROTOKOLÜ/PLANI	01.06. 2015		Türkçe ☒ İngilizce ☐ Diğer ☐
	BİLGİLENDİRİLMİŞ GÖNÜLLÜ OLUR FORMU	01.06.2015		Türkçe ☒ İngilizce ☐ Diğer ☐
Karar Bilgileri	**Karar No: 272**	**Tarih: 02.06.2015**		
	Yukarıda bilgileri verilen Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu başvuru dosyası ile ilgili belgeler araştırmanın gerekçe, amaç, yaklaşım ve yöntemleri dikkate alınarak incelenmiş ve araştırmanın etik ve bilimsel yönden uygun olduğuna **"oybirliği"** ile karar verilmiştir.			

İSTANBUL MEDİPOL ÜNİVERSİTESİ GİRİŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU	
BAŞKANIN UNVANI / ADI / SOYADI	Doç. Dr. Hanefi ÖZBEK

Unvanı/Adı/Soyadı	Uzmanlık Alanı	Kurumu	Cinsiyet		Araştırma ile ilişki		Katılım *		İmza
Prof. Dr. Şeref DEMİRAYAK	Eczacılık	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Prof. Dr. Tangül MÜDOK	Histoloji ve Embriyoloji	İstanbul Medipol Üniversitesi	E ☐	K ☒	E ☐	H ☒	E ☒	H ☐	
Doç. Dr. Hanefi ÖZBEK	Farmakoloji	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☒	H ☐	E ☐	H ☒	
Yrd. Doç. Dr. Sibel DOĞAN	Psiko-onkoloji	İstanbul Medipol Üniversitesi	E ☐	K ☒	E ☐	H ☒	E ☒	H ☐	
Yrd. Doç. Dr. Hüseyin Emir YÜZBAŞIOĞLU	Protetik Diş Tedavisi	İstanbul Medipol Üniversitesi	E ☒	K ☐	E ☐	H ☒	E ☒	H ☐	
Yrd. Doç. Dr. İlknur KESKİN	Histoloji ve Embriyoloji	İstanbul Medipol Üniversitesi	E ☐	K ☒	E ☐	H ☒	E ☒	H ☐	
Yrd. Doç. Dr. Muhammed Fatih EVCİMİK	Kulak-Burun Boğaz	Özel Nisa Hastanesi	E ☒	K ☐	E ☐	H ☒	E ☐	H ☒	

* :Toplantıda Bulunma

12. ÖZGEÇMIŞ

Kişisel Bilgiler

Adı	Farzin	**Soyadı**	Hajebrahimi
Doğum Yeri	Tabriz-Iran	**Doğum Tarihi**	26.03.1985
Uyruğu	Iran	**TC Kimlik No**	99463340648
E-mail	fhajebrahimi@medipol.edu.tr	**Tel**	05393184428

Eğitim Düzeyi

	Mezun Olduğu Kurumun Adı	**Mezuniyet Yılı**
Lisans	Tabriz University of Medical Sciences	2009
Lise	Tabriz Madani High School	2004

İş Deneyimi

	Görevi	**Kurum**	**Süre (Yıl-Yıl)**
1	Fizyoterapist	Iran	2008-2011
2	Arastirma Gorevlisi	İstanbul Medipol Universitesi	2015-

Yabancı Dilleri	**Okuduğunu Anlama**	**Konuşma**	**Yazma**
İngilizce	İyi	Orta	iyi

Yabancı Dil Sınav Notu								
KPDS	**YDS**	**IELTS**	**TOEFL IBT**	**TOEFL PBT**	**TOEFL CBT**	**FCE**	**CAE**	**CPE**
-	-	6.5 (academic)	-	-	-	-	-	-

	Sayısal	Eşit Ağırlık	Sözel
ALES PUANI			

Bilgisayar Bilgisi

Program	**Kullanma Becerisi**
Microsoft Office Programs	İyi
SPSS	Orta
Visual Basic	yok