T.C.

YEDITEPE UNIVERSITY
INSTITUTE OF HEALTH SCIENCES
DEPARTMENT OF PHYSIOTHERAPY& REHABILITATION THESIS

Comparison of the Effects of Physical Activity and Virtual Reality Training on Physical Function, Cognition and Quality of Life in Patients with schizophrenia

MASTER OF PHYSIOTHERAPY & REHABILITATION THESIS

SALSABEEL ABDULHADY, PT

İSTANBUL-2023

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İSTANBUL-2023

THESIS APPROVAL FORM

Institute: Yeditepe University Institute of Health Sciences

Program : Fizyoterapi Ve Rehabilitasyon Yüksek Lisans Programi

Title of the Thesis: Comparison of the Effects of Physical Activity and Virtual Reality Training on Physical Function, Cognition and Quality of Life in Patients with Schizophrenia

Owner of the Thesis: PT. Salsabeel Abdulhady

Examination Date: 20.06.2023

This study has been approved as a Master/Doctorate Thesis in regard to content and quality by the Jury.

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APPROVAL

This thesis has been deemed by the jury in accordance with the relevant articles of Yeditepe University Graduate Education and Examinations Regulation and has been approved by Administrative Board of Institute with decision dated ..... and numbered .....

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Kurum : Yeditepe Üniversitesi Sağlık Bilimleri Enstitüsü

Program : Fizyoterapi Ve Rehabilitasyon Yüksek Lisans Programi

Tez Başlığı: Comparison of the Effects of Physical Activity and Virtual Reality Training on Physical Function, Cognition and Quality of Life in Patients with schizophrenia

Tez Sahibi: Fzt. Salsabeel ABDULHADY

Sınav Tarihi : 20.06.2023

Bu çalışma jurimiz tarafından kapsam ve kalite yönünden Yüksek Lisans Tezi olarak kabul edilmiştir.

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ONAY

Bu tez Yeditepe Üniversitesi Lisansüstü Eğitim-Öğretim ve Sınav Yönetmeliğinin ilgili maddeleri uyarınca yukarıdaki jüri tarafından uygun görülmüş ve Enstitü Yönetim Kurulu'nun ……tarih ve ..... sayılı kararı ile onaylanmıştır.

Prof. Dr. Bayram YILMAZ

Sağlık Bilimleri Enstitüsü Müdür

DECLARATION

With this statement, I hereby declare that I have obtained the data, information, and documents used in my master's thesis titled " Comparison of the Effects of Physical Activity and Virtual Reality Training on Physical Function, Cognition and Quality of Life in Patients with Schizophrenia" in accordance with academic and ethical standards. I confirm that I have presented the evaluation and results in accordance with scientific ethics and moral principles. I have appropriately cited the works referenced in my thesis following scientific guidelines. I affirm that my thesis is original, and I have not violated any patent or copyright laws in its conduct and writing.

20.06.2023

Salsabeel Abdulhady, PT.

DEDICATION

I dedicate this to my family for their unconditional love, support, and encouragement.

ACKNOWLEDGEMENTS

As I reflect on the completion of my master's degree thesis, my heart is overwhelmed with immense gratitude. Words cannot fully express the depth of appreciation I feel towards my family. Their unwavering support, boundless encouragement, and unshakeable belief in me have been the bedrock of my academic journey. Through the ups and downs, their love, understanding, and countless sacrifices have provided me with the strength to persevere. I am forever indebted to their presence in my life, and I carry their love and support with me as a cherished treasure.

I am grateful to my advisor, *Ebru Akbuga Koc*, for her exceptional guidance and unwavering support throughout my studies. Her transformative feedback and insights, along with her belief in my abilities and encouragement to strive for excellence, have propelled me to surpass my expectations. She has been an invaluable mentor and role model, instilling in me the values of dedication, perseverance, and academic rigor. Her guidance in keeping me on track, meeting deadlines, and staying focused on my research goals has been a true lifeline. I am deeply humbled by her mentorship and cherish the invaluable lessons she has taught me.

In addition, I want to acknowledge the contributions of my loving partner, my best friends, and the faculty members who have been instrumental in my journey. Their belief in my potential and their continuous support have been a source of inspiration and strength. Their words of encouragement, late-night conversations, and intellectual discussions have shaped my growth as a scholar and a person. To each and every one of them, I am eternally grateful for their presence in my life.

As I embark on the next chapter of my life, I carry with me the profound influence of my family, my advisor, my partner, my best friends, and the entire academic community who have nurtured my growth. With their love and guidance, I am ready to embrace new challenges, venture into uncharted territories, and make a lasting impact. My journey would not have been the same without their belief in me, and for that, I am forever grateful.

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LIST OF SYMBOLS AND ABBREVIATIONS

6MWT	6 Minutes Walking test
BBT	Berg Balance Test
CDSS	Calgary Depression Scale for Schizophrenia
HRQoL	Health-Related Quality of Life
IADL	Instrumental Activities of Daily Living
KATZ ADL	Katz Activities of Daily Living
MMSE	Mini-Mental State Examination
PA	Physical Activity
PwS	Patients with schizophrenia
SF-36	36-Item Short Form Quality of Life Survey
SPSS	Statistical Package Analysis for Health Sciences
SST	Sit-To-Stand Test
TUG	Time-Up-and-Go
VR	Virtual reality

ABSTRACT

Abdulhady, S. (2023) Comparison of the Effects of Physical Activity and Virtual Reality Training on Physical Function, Cognition and Quality of Life in Patients with Schizophrenia

This thesis aims to compare the effects of Physical Activity (PA) and Virtual Reality (VR) training on physical function, cognition, and quality of life in patients with schizophrenia (PwS). The study was conducted over 12 Weeks and included three groups: a VR group (n=15), a PA group (n=12), and a Control group. The primary outcome measures focused on physical function, cognition, and quality of life using the SF-36 questionnaire.

The results revealed significant differences in several areas. The PA group experienced a significant decrease in sedentary time compared to their baseline measurements ($p<0.05$) and exhibited a significant increase in exercise time compared to their baseline measurements ($p<0.05$). The VR intervention had a positive impact on the physical health of the participants, as indicated by improved Physical Component Summary (PCS) scores ($p<0.05$). Furthermore, the VR group showed statistically higher average post-test right-hand dynamometer scores than pre-test scores ($p<0.05$). Both the VR and PA groups showed statistically higher mean Sit-to-Stand (SST) measurements in the post-test compared to the other groups ($p<0.05$). In addition, in the VR and PA groups, the Timed Up and Go (TUG) averages obtained in the post-test were statistically lower than the pre-test time ($p<0.05$). Moreover, in the VR and Control groups, the 6-Minute Walk Test (6MWT) Rounds mean was statistically higher than the pre-test time ($p<0.05$). Within the PA group, the average Calgary Depression Scale for Schizophrenia (CDSS) scores significantly decreased after 12 weeks ($p<0.05$). Additionally, in the PA group, the average Mini-Mental State Examination (MMSE) score in the post-test was statistically higher than in the pre-test ($p<0.05$).

These findings suggest that both PA and VR interventions have beneficial effects on physical function, cognition, and quality of life in PwS. Specifically, the PA intervention reduced sedentary behavior and increased exercise time ($p<0.05$), while the VR intervention positively impacted physical health ($p<0.05$). The results highlight the importance of incorporating PA and VR interventions to enhance the well-being of individuals with schizophrenia. Further research and implementation of these interventions could contribute to improving the overall care and management of PwS.

Keywords: schizophrenia, Nintendo Wii Fit, interactive gaming, physical engagement, immersion, balance, Quality of Life, therapeutic intervention.

ÖZET

Abdulhady, S. (2023). Şizofreni Hastalarında Fiziksel Aktivite ve Sanal Gerçeklik Eğitiminin Fiziksel Fonksiyon, Biliş ve Yaşam Kalitesi Üzerine Etkilerinin Karşılaştırılması

Bu tez, şizofreni hastalarında fiziksel fonksiyon, bilişsel yetenek ve yaşam kalitesi üzerinde Fiziksel Aktivite (FA) ve Sanal Gerçeklik (SG) eğitimlerinin etkilerini karşılaştırmayı amaçlamaktadır. Çalışma 12 hafta boyunca gerçekleştirilmiş olup üç gruptan oluşmaktadır:, VR grubu (n=15), FA grubu (n=12) ve Kontrol grubunu içermektedir. Temel sonuç ölçümleri, SF-36 anketi kullanılarak fiziksel fonksiyon, bilişsel yetenek ve yaşam kalitesine odaklanmıştır.

Sonuçlar birçok alanda anlamlı farklılıklar ortaya koymuştur. FA grubu, temel ölçümlerine göre oturarak geçirilen sürede anlamlı bir azalma ($p<0.05$) ve egzersiz süresinde anlamlı bir artış göstermiştir ($p<0.05$). SG müdahalesinin katılımcıların fiziksel sağlığı üzerinde olumlu bir etkisi olduğu, İçerik Bileşen Özeti (PCS) skorlarının iyileştiği şeklinde bulgular elde edilmiştir ($p<0.05$). Ayrıca, VR grubu, ön test skorlarına kıyasla istatistiksel olarak daha yüksek ortalama sağ el dinamometre skorları göstermiştir ($p<0.05$). Hem VR hem de FA grupları, diğer gruplara kıyasla otur-kalk (SST) ölçümlerinde istatistiksel olarak daha yüksek ortalama değerlere sahiptir ($p<0.05$). Ek olarak, VR ve FA gruplarında, Zamanlı Kalk ve Yürü (TUG) testi sonuçlarının ön test zamanına göre istatistiksel olarak daha düşük olduğu görülmüştür ($p<0.05$). Dahası, VR ve Kontrol gruplarında, 6 Dakika Yürüme Testi (6MWT) tur ortalamalarının ön test zamanından istatistiksel olarak daha yüksek olduğu gözlenmiştir ($p<0.05$). FA grubu içinde, 12 hafta sonra ortalama Calgary Şizofreni Depresyon Ölçeği (CDSS) skorları anlamlı bir şekilde azalmıştır ($p<0.05$). Ayrıca, FA grubunda, ön teste kıyasla ortalama Mini Mental Durum Muayenesi (MMSE) skoru istatistiksel olarak daha yüksek bulunmuştur ($p<0.05$).

Bu bulgular, FA ve SG müdahalelerinin şizofreni hastalarında fiziksel fonksiyon, bilişsel yetenek ve yaşam kalitesi üzerinde faydalı etkilere sahip olduğunu göstermektedir. Özellikle, FA müdahalesi oturarak geçirilen süreyi azaltırken egzersiz süresini artırmıştır ($p<0.05$), SG müdahalesi ise fiziksel sağlığı olumlu yönde etkilemiştir ($p<0.05$). Sonuçlar, şizofreni hastalarının genel iyi oluşunu artırmak için FA ve SG müdahalelerinin entegre edilmesinin önemini vurgulamaktadır. Bu müdahalelerin daha fazla araştırılması ve uygulanması, şizofreni hastalarının genel bakım ve yönetiminin geliştirilmesine katkı sağlayabilir.

Anahtar Kelimeler: Anahtar kelimeler: şizofreni, Nintendo Wii Fit, etkileşimli oyun, fiziksel etkileşim, içerme, denge, esneklik, terapötik müdahale

1. INTRODUCTION AND PURPOSE

Schizophrenia is a debilitating mental disorder characterized by disruptions in thinking, perception, emotions, and social functioning [1]. Patients with schizophrenia [PwS) often experience impairments in physical function, cognition, and quality of life, which can significantly impact their overall well-being. As part of the pursuit to enhance treatment outcomes, researchers, including physical therapists, have explored various adjunctive therapies that can potentially alleviate these impairments. The objective of this research is to assess and contrast the impacts of physical activity (PA) and virtual reality (VR) training on the physical function, cognition, and quality of life in individuals diagnosed with schizophrenia (PwS). This will be compared to a control group that receives conventional occupational therapy.

1.1 Background

Physical activity has been acknowledged as a favorable intervention for individuals with mental disorders, including schizophrenia [2]. Consistently participating in physical activity has been linked to enhanced physical fitness, cardiovascular well-being, and muscle strength. Furthermore, studies have shown that physical activity can positively influence cognitive function, including attention, memory, and executive functions, in individuals with schizophrenia [2, 3]. These improvements in physical and cognitive domains can potentially lead to enhanced quality of life for these individuals.

Virtual reality training, on the other hand, is an emerging therapeutic approach that provides immersive and interactive experiences through computer-generated simulations. While the benefits of physical activity have been extensively studied in schizophrenia, research investigating the specific effects of virtual reality training in this population is limited [4]. There is a need to explore the potential benefits of VR in improving physical function, cognition, and quality of life in individuals with schizophrenia to expand our understanding of its therapeutic value.

1.2 Significance

Understanding the comparative effects of physical activity and virtual reality training on physical function, cognition, and quality of life in PwS, in comparison to the control group undergoing regular occupational therapy, holds significant importance. By comparing these interventions, we can identify their relative effectiveness and potential benefits in addressing the impairments associated with schizophrenia. This knowledge can inform clinicians, researchers, and healthcare professionals, including physical therapists, in making evidence-based decisions regarding using these interventions in clinical practice. Additionally, it may contribute to the development of personalized treatment approaches that optimize outcomes and improve the overall well-being of individuals with schizophrenia.

1.3 Overview

This study describes a comparative analysis of three groups: a physical activity intervention group, a virtual reality training intervention group, and a control group that undergoes regular occupational therapy at the center. The study will recruit a sample of individuals diagnosed with schizophrenia and randomly assign them to one of the three groups. Assessments of physical function, cognitive performance, and quality of life will be conducted before and after the interventions to evaluate the effectiveness of each approach. The findings of this study will contribute to the exist literature and inform the development of evidence-based interventions for individuals with schizophrenia, particularly in the context of physical therapy.

1.4 Hypothesis

Based on previous research indicating the benefits of physical activity and the limited available evidence on the benefits of virtual reality training for individuals with schizophrenia, we hypothesize that both interventions (PA and VR) will provide similar positive effects on physical function, cognition, and quality of life in patients with schizophrenia, in comparison to the control group undergoing regular occupational therapy at the center.

However, this study aims to examine whether any specific differences exist between the two interventions, providing further insights into their respective efficacy and potential advantages.

2. THEORETICAL INFORMATION AND LITERATURE

2.1 Description And History

Schizophrenia is a multifaceted mental disorder marked by a variety of symptoms, such as hallucinations, delusions, disorganized thinking, and impaired social functioning [1]. Its history is both extensive and intriguing, stretching from ancient civilizations to the present day. In fact, ancient Egyptian medical texts documented a condition resembling schizophrenia, which they called "hebephrenia" [2]. However, it was not until the late 19th century that Emil Kraepelin, a German psychiatrist, provided a comprehensive clinical description of schizophrenia as a distinct illness [3]. Kraepelin's work laid the foundation for understanding the disorder as a separate diagnostic entity. Over the years, advancements in research have contributed to a better understanding of the neurobiological and genetic underpinnings of schizophrenia, as well as the environmental and social factors that contribute to its development.

2.2 Epidemiology

Understanding the epidemiology of schizophrenia is essential for assessing its prevalence, incidence, and distribution in different populations. Epidemiological studies have consistently shown that schizophrenia affects approximately 1% of the global population [1]. However, there are variations in prevalence rates across countries and regions. A comprehensive systematic review reported higher prevalence rates in urban areas compared to rural settings [2]. The age of onset for schizophrenia is typically in late adolescence or early adulthood. The burden of the disorder is substantial, as it leads to long-term disability and places significant economic and social burdens on individuals, families, and healthcare systems. The prevalence of schizophrenia may vary slightly between different countries and regions. It is difficult to provide an exact prevalence rate for schizophrenia in Turkey as limited data is available on this topic. However, the prevalence of schizophrenia in Turkey is likely similar to the global average [1,2].

2.3 Etiology

The development of schizophrenia is influenced by multiple factors, involving a intricate interplay of genetic, neurobiological, and environmental elements. Research, including family, twin, and adoption studies, has consistently indicated a significant genetic

contribution, with heritability estimates ranging from 60% to 80% [1]. Recent genome-wide association studies (GWAS) and whole-genome sequencing have identified several genes associated with schizophrenia, supporting its polygenic nature [2]. Neurobiological abnormalities in brain structure and function, particularly in the prefrontal cortex, hippocampus, and dopamine pathways, have been observed in individuals with schizophrenia. Environmental factors, including prenatal and perinatal complications, exposure to stressors, and substance abuse, can also contribute to the development of schizophrenia, especially in individuals with a genetic vulnerability [3].

2.4 Diagnosis of Schizophrenia

Schizophrenia is diagnosed according to the DSM-5 diagnostic criteria, which encompass specific symptoms, social/occupational impairment, duration, and exclusion criteria [1], outlined in Table 1. The characteristic of the symptoms comprise delusions, hallucinations, disorganized speech, grossly disorganized behavior, and negative symptoms [1]. Moreover, there should be a noticeable decline in functioning related to work, relationships, or self-care [1]. To qualify for a diagnosis, the disturbance must persist for at least six months, with active symptoms present for a significant portion of that duration [1]. Additionally, potential alternative causes, such as substance use or medical conditions, must be ruled out [1]. These criteria serve as a standardized framework for diagnosing schizophrenia, facilitating precise identification and appropriate treatment.

Table 1 DSM-5 Diagnostic Criteria

Criteria	Description
Characteristic Symptoms	Delusions, hallucinations, disorganized speech, grossly disorganized or catatonic behavior, negative symptoms
Social/Occupational Dysfunction	Marked decline in functioning in work, interpersonal relations, or self-care
Duration	Continous signs of disturbance presisting for at least six months, with active symptoms present for a significant portion of that time
Exclusion	Disturbance not attributable to substance use or other medical conditions
Schizoaffective And Mood Disorder Exclusion	Disturbance not better explained by schizoaffective disorder, depressive or bipolar disorder with psychotic features, or other specified conditions

2.5 Clinical Signs of Schizophrenia

Schizophrenia exhibits a spectrum of clinical features encompassing both positive and negative symptoms [1]. Positive symptoms are characterized by abnormal experiences or behaviors that are not typically observed in healthy individuals. These include delusions, which are firmly held false beliefs despite evidence to the contrary, and hallucinations, perceptual experiences occurring without external stimuli [1] (Table 2.). Disorganized speech, marked by frequent derailment or incoherence, and grossly disorganized or catatonic behavior are also common positive symptoms [1].

On the other hand, negative symptoms indicate a reduction or absence of normal functioning. They involve diminished emotional expression or avolition, leading to a lack of motivation and drive to engage in purposeful activities [1]. Individuals with schizophrenia may display reduced speech and social withdrawal, resulting in social isolation [1]. Other negative symptoms encompass a diminished sense of pleasure or interest in activities, impaired attention and executive functioning, as well as cognitive deficits, including difficulties with memory, attention, and problem-solving [1].

The presence of both positive and negative symptoms contributes to the clinical presentation and impact of schizophrenia. These symptoms vary in severity and can significantly impair daily functioning and quality of life for individuals with the disorder.

Table 2 Clinical Signs (Positive and Negative Symptoms)

	Positive Symptoms	**Negative Symptoms**
	Delusions	Diminished emotional expression or avolition
	Hallucinations	Reduced speech and motivation
	Disorganized speech (e.g., derailment or incoherence)	Social withdrawal and isolation
	Grossly disorganized or catatonic behavior	Lack of pleasure or interest in activities
		Impaired attention and executive functioning
		Cognitive deficits (e.g., difficulties with memory, attention, and problem-solving

2.6 Prognosis

The prognosis of schizophrenia, a complex and chronic mental disorder, is influenced by various factors that impact the course and outcome of the illness [4]. Several studies conducted between 2018 and 2023 have identified prognostic factors associated with

schizophrenia. Positive prognostic factors include a later age of onset, good premorbid functioning, and the presence of mood symptoms [7,3]. Later onset of schizophrenia is generally associated with a milder course and better functional outcomes [7]. Good premorbid functioning, characterized by higher levels of social and occupational functioning before the onset of symptoms, is linked to a more favorable prognosis [7]. The presence of mood symptoms alongside psychotic symptoms has been associated with a better prognosis, potentially indicating a less severe form of schizophrenia [8].

Conversely, negative prognostic factors include early age of onset, poor premorbid functioning, and poor response to treatment [9,5]. Early onset of schizophrenia, particularly during adolescence or early adulthood, is associated with more severe symptoms and a higher risk of chronicity [9]. Poor premorbid functioning, marked by social and cognitive impairments before illness onset, predicts a worse outcome and greater disability [4]. A poor response to treatment, including inadequate response to antipsychotic medications or persistent medication side effects, can contribute to a poorer prognosis [5].

Additional factors that influence prognosis include the presence of comorbid substance use disorders, social support, and access to early intervention services [9,6]. Substance use disorders are associated with worse outcomes in schizophrenia and can complicate treatment [9]. Adequate social support from family, friends, and community resources can positively impact recovery and functional outcomes [6]. Access to early intervention services, such as specialized programs offering comprehensive treatment and support in the early stages of the illness, has shown promising results in improving prognosis [6].

2.7 Treatment options

2.7.1 Pharmacologic medications

The treatment of schizophrenia typically involves a combination of pharmacologic and nonpharmacologic interventions. Pharmacologic medications play a central role in managing symptoms and preventing relapse. In addition to nonpharmacologic interventions, such as Physical therapy and occupational therapy etc] Patients with schizophrenia (PwS) also need pharmacologic treatment is crucial in managing schizophrenia. Antipsychotic medications, such as risperidone, olanzapine, and aripiprazole, are commonly prescribed to target positive symptoms, with studies demonstrating their efficacy in reducing symptoms and improving functioning. [10]

Clozapine is often reserved for treatment-resistant cases and has shown superior effectiveness in multiple clinical trials. [11,12]

2.7.2 Physiotherapy In Schizophrenia

In recent years, there has been growing recognition of the potential benefits of incorporating physiotherapy interventions as part of the comprehensive treatment approach for patients with schizophrenia. Physiotherapy in schizophrenia aims to address the physical health needs of individuals by promoting physical activity, improving fitness levels, and enhancing the overall quality of life [13]. Regular exercise has been shown to positively affect various aspects of schizophrenia, including reducing symptoms, improving cognitive function, and enhancing social functioning [14]. It can also help manage weight gain; a common side effect of antipsychotic medications used to treat schizophrenia [15]. Specific physiotherapy interventions for schizophrenia may include aerobic exercises, strength training, flexibility exercises, and balance training [16]. These interventions can be tailored to the individual's abilities and preferences, taking into account any physical limitations or comorbidities that may be present. Physiotherapists play a crucial role in assessing physical health, designing exercise programs, and providing guidance and support to individuals with schizophrenia.

2.7.3 Exercise in schizophrenia

Research studies conducted between 2018 and 2023 have demonstrated the potential benefits of physiotherapy interventions in schizophrenia. A randomised controlled trial found that a combined program of aerobic exercise and yoga led to improvements in negative symptoms, physical fitness, and overall well-being in individuals with schizophrenia [17,23,31]. Another study showed that a 12-week supervised exercise program resulted in reduced sedentary behavior and improved cardiorespiratory fitness in patients with schizophrenia [18].

2.7.4 Virtual Reality in Schizophrenia

Virtual Reality (VR) technology has gained increasing attention as a potential therapeutic tool in treating various mental health conditions, including schizophrenia. VR offers a simulated environment that allows individuals to interact with computer-generated stimuli in a controlled and immersive manner.

In recent years, studies have explored the use of VR interventions as a complementary approach to traditional therapy in schizophrenia. One area where VR shows promise is in the treatment of positive symptoms, particularly hallucinations. Virtual reality can create realistic auditory and visual stimuli, providing a safe and controlled environment for individuals to confront and manage their hallucinations [13]. Studies have reported positive outcomes, such as reductions in the frequency and distress associated with hallucinations following VR-based interventions [14,25]. VR can also be utilized to simulate social situations, address deficits in social skills and promote social interaction and integration [15,29].

Moreover, virtual reality [VR] has been employed in cognitive rehabilitation for individuals with schizophrenia. Cognitive deficits, including impairments in attention, memory, and executive functions, are prevalent in schizophrenia and can profoundly influence daily functioning. VR-based cognitive training programs have demonstrated encouraging outcomes in enhancing cognitive performance, such as attention and working memory, among individuals with schizophrenia [16,26]. Moreover, VR has been employed as a tool for psychoeducation and psychotherapeutic interventions. By creating simulated environments, VR can provide immersive and engaging educational experiences that help individuals better understand their condition and cope with symptoms [17,27]. Virtual reality exposure therapy has also been explored for the treatment of specific phobias or anxiety disorders co-occurring with schizophrenia [18-32]. Although research on VR in schizophrenia is ongoing, its potential benefits are promising. However, more studies are required to determine optimal protocols, long-term effectiveness, and the feasibility of integrating VR into routine clinical practice.

2.7.5 Nintendo Wii in Physical Therapy

Nintendo Wii, a popular gaming console, has been increasingly recognized for its potential applications in physical therapy. The interactive and motion-controlled gameplay of the Nintendo Wii offers opportunities for therapeutic exercises that can be engaging and enjoyable for patients. Several studies have explored the use of Nintendo Wii as an adjunctive tool in physical therapy interventions, particularly for balance and rehabilitation exercises. Research conducted between 2018 and 2023 has shown promising results in utilizing Nintendo Wii in physical therapy. A study by Chang et al. (2019) investigated the effects of Wii Fit training on balance control in older adults. The findings indicated that Wii Fit exercises improved balance performance and reduced the

risk of falls [19]. Additionally, a randomized controlled trial by Cabral et al. (2020) examined the efficacy of Wii-based exercises in stroke rehabilitation [20]. The results demonstrated that Nintendo Wii interventions improved motor function and functional capacity in stroke survivors.

Incorporating Nintendo Wii into physical therapy provides a novel and interactive approach to enhance patient engagement and motivation. The use of motion-controlled games on the Nintendo Wii console allows individuals to perform therapeutic exercises while enjoying a gaming experience. However, further research is needed to explore the long-term effectiveness, optimal protocols, and specific patient populations that may benefit the most from this approach.

2.7.6 Literature about Nintendo Wii and Schizophrenia

While there is limited specific literature on the use of Nintendo Wii in the context of schizophrenia, the potential benefits of gaming interventions in this population have been explored. Numerous studies have examined the impact of interactive gaming, including the Nintendo Wii, on cognitive and functional outcomes in individuals with schizophrenia. For instance, Subramaniam et al. [2018] conducted a study to assess the feasibility and effectiveness of using virtual reality-based Nintendo Wii games for cognitive training in schizophrenia [21]. The results showed significant enhancements in cognitive functioning, particularly in attention and working memory. Similarly, Hsu et al. (2021) conducted a study to investigate the effects of a Wii-based exercise program on physical fitness and quality of life in individuals with schizophrenia [22]. The findings demonstrated that the Wii exercise program led to improvements in physical fitness parameters and an overall enhancement in quality of life [22].

Although the literature on the use of Nintendo Wii specifically in schizophrenia is limited, these studies suggest the potential benefits of incorporating interactive gaming interventions in cognitive training and physical fitness promotion for individuals with schizophrenia. Further research is needed to explore the optimal use of Nintendo Wii in schizophrenia treatment, including the development of tailored gaming programs and the assessment of long-term effects.

3. MATERIAL AND METHODS

3.1 Study Design

In this present study, a randomized controlled trial (RCT) design was utilized to assess and compare the impacts of physical activity (PA) and Virtual Reality (VR) training on physical function, cognition, and quality of life in patients with schizophrenia. The study comprised three groups: a PA group, a VR group, and a control group that received regular occupational therapy.

3.2 Setting

The study was conducted in a community mental health center at the Kartal Dr Lütfi Kırdar City Hospital in Istanbul, Turkey. The center provided a suitable environment for the intervention and assessment of the participants.

3.3 Participants

Schizophrenia outpatients from a single Community Mental Health Center were recruited for the study. Inclusion criteria required participants to meet the following points:

3.3.1 Inclusion Criteria:

[1] Eligible participants had to fall within the age range of 20 to 77 years.

[2] Participants were required to express willingness to take part in the research.

[3] Diagnosis of schizophrenia in participants was based on the criteria outlined in the DSM-IV.

[4] Exclusion criteria included participants diagnosed with mental disability, alcoholism, or drug addiction.

[5] Participants needed to achieve a minimum score of 40 points on the Global Assessment of Functioning (GAF) test, indicating a non-severe mental state.

[6] Participants had to demonstrate full comprehension of the purpose and content of the research. Participants had to be capable of fully understanding the purpose and content of the research.

[7] Participants had to be able to participate in physical activity that requires musculoskeletal movement without difficulty, as determined by self-report.

3.3.2 The exclusion criteria:

[1] Participants with substantial cardiovascular, neuromuscular, endocrine, or other conditions that could hinder safe participation in the study were not included.

[2] Individuals diagnosed with alcohol or substance abuse were also excluded from the study.

[3] Participants with a secondary diagnosis of neurological disease or disease associated with the consumption of toxins, addiction to technology, or compulsive gambling were excluded.

[4] Participants who could not read, understand, or respond to assessment tests were excluded.

3.4 Interventions

3.4.1 The Physical Activity (PA)

The group engaged in a 45-minute exercise program, which included warm-up exercises [5 minutes), strengthening exercises (10 minutes), balance and cardiovascular endurance exercises (20 minutes), aerobic exercises (20 minutes), and cool-down exercises with breathing control (5 minutes). Participants in this group also continued with regular occupational therapy sessions.

3.4.2 The Virtual Reality (VR)

The group participated in a 45-minute session using the Nintendo Wii-Fit™ game. The session comprised games for warm-up exercises (5 minutes), games for strengthening exercises (10 minutes), balance exercises using a Balance board (20 minutes), aerobic exercises (20 minutes), and cool-down exercises (5 minutes), all within the games. Similar to the PA group, participants in the VR group also continued with regular occupational therapy sessions. The VR interventions utilized the Nintendo Wii-Fit™ console, a Balance board and a TV screen.

3.4.3 The Control groups

Received regular occupational therapy sessions without additional interventions.

3.5 Primary outcome measures

To assess the effects of the interventions, the following outcome measures were used:

3.5.1 Physical function

Subjective measurements were done using SIMPAQ [33,34) as well as Objective measures such as cardiorespiratory fitness was evaluated using the 6-minute walking test

[35]. The balance was assessed using the Berg Balance Test [36-46]. The Functional mobility was evaluated using the Time Up and Go test [37]. Lower extremity muscle strength was assessed using the Sit to Stand Test [38]. Upper extremity muscle strength was measured using a Dynamometer. [39].

3.5.2 Cognition

Standardized cognitive assessments, such as the Mini-Mental State Examination (MMSE) as specific cognitive domains assessments [40].

3.5.3 Quality of life

Validated self-report questionnaires, such as the Short Form Health Survey (SF-36), to assess the participants' perceived quality of life [41,45].

3.6 Data Analysis

Statistical analysis was performed using appropriate tests, such as analysis of variance (ANOVA) or non-parametric equivalents, to compare the outcomes between the three groups. Post-hoc analyses, such as Bonferroni corrections, were conducted to determine specific group differences if significant effects were found.

3.7 Ethical Considerations

The study strictly adhered to ethical guidelines, ensuring the protection and rights of all participants. Informed consent was obtained from each participant before their involvement in the study. Additionally, the study protocol underwent rigorous ethical review and received approval from the appropriate institutional review board. The ethical committee form number for this study was 64-2023.

3.8 Study Process

Participants were enrolled in the study from February 2023 to March 2023 at the Kartal Dr. Lütfi Kırdar City Hospital in Istanbul, Turkey, which served as a community mental health center. All patients who sought treatment at the center during this period were invited to participate in the study. A total of 52 patients were assessed for eligibility, and ultimately, 38 participants who met the inclusion criteria were included in the study. Prior to their participation, the aim and procedures of the study were explained to each volunteer, and written informed consent was obtained.

The participants underwent a comprehensive assessment of various measures related to physical function, cognition, and activities of daily living. Physical function was evaluated using tests such as the 6-Minute Walk Test (6MWT), Berg Balance Test (BBT), Timed Up and Go Test (TUG), Sit-to-Stand Test (SST), and Dynamometer measurements. Cognition was assessed using the Mini-Mental State Examination (MMSE) and Calgary Depression Scale Cognitive (CDSS) [41,46]. Furthermore, functional abilities were evaluated using the SF-36 Questionnaire and KATS ADL (Katz Activities of Daily Living) questionnaire, and instrumental activities of daily living were assessed using the IADL (Instrumental Activities of Daily Living) questionnaire. These assessments were conducted before and after the interventions, as depicted in **Figure 2**.

3.9 Study Protocol

This study is a prospective randomized controlled trial to compare the effects of physical activity and Virtual Reality Training (VRT) on physical function, cognition, and quality of life in individuals diagnosed with schizophrenia. The participants were recruited from the Kartal Dr. Lütfi Kırdar City Hospital Community Mental Health Center in Istanbul, based on DSM-5 diagnostic criteria. The study consisted of three groups: the Physical Activity (PA) Group, the VR Group utilizing Nintendo Wii-Fit games, and the Control Group receiving regular occupational therapy.

In the PA Group, participants engaged in a 45-minute exercise program supervised by an experienced physiotherapist, incorporating warm-up exercises, strength training, balance exercises, and aerobic activities. The VR Group undergo a 45-minute training session guided by the same physiotherapist, using Nintendo Wii-Fit games that include warm-up exercises, strength training, balance exercises, and aerobic activities. The VR Group used the Nintendo Wii-Fit console, balance board, and television screen for their training.

The study aims to investigate the impact of these interventions on physical function, cognitive abilities, and overall quality of life among patients with schizophrenia. By comparing the outcomes of the PA Group, VR Group, and Control Group, the researchers sought to gain insights into the effectiveness of physical activity and VR as therapeutic approaches for patients with schizophrenia (PwS).

3.10 Assessment Methods

3.10.1 Simple Physical Activity Questionnaire (SIMPAQ)

The participants were administered a structured questionnaire encompassing social and demographic information (see **APPENDIX C**). This questionnaire consisted of items about age, marital status, educational background, presence of systemic diseases, diagnosis, medication usage, and alcohol or cigarette consumption.

To assess the physical activity levels in patients with schizophrenia (PwS), the participants were also administered the Simple Physical Activity Questionnaire (SIMPAQ). This questionnaire offers a reliable and straightforward approach to quantifying physical activity, facilitating monitoring activity patterns over time. Senel et al. (2022) conducted a reliability and translation study of SIMPAQ, successfully adapting and translating it into Turkish for the evaluation of its psychometric properties among patients [34]. Consequently, we chose SIMPAQ as our tool to assess various types of physical activities, including walking, running, and cycling, enabling a comprehensive evaluation of participants' activity levels.

SIMPAQ encompasses multiple physical activities, including leisure time, occupational, transportation, and household activities. This comprehensive approach enables a holistic assessment of patients' physical activity patterns, capturing structured exercise routines and daily activities. This is particularly relevant for PwS, as their physical activity often extends beyond formal exercise programs. The questionnaire comprises questions regarding the frequency, duration, and intensity of various physical activities within different domains. It explores the frequency of engagement in activities such as exercise, household chores, work-related tasks, and transportation. Participants are also asked to provide information on the duration and intensity of these activities. Additionally, SIMPAQ assesses sedentary behavior by inquiring about the time spent sitting or engaging in activities that require minimal physical effort.

SIMPAQ does not utilize a specific grading system. Instead, it yields quantitative data based on participants' responses, which are typically analyzed by calculating summary measures such as total activity time, average intensity, and overall physical activity level (see **APPENDIX D**)

3.10.2 Physical function Assessment

Physical performance was assessed using the following tests:

Table 3 Physical Performance tests

Test	Explanation	Instructions
6-Minute Walk Test [35]	Measures cardiorespiratory fitness by walking as far as possible in six minutes	"Walk as far as you can in a straight path or designated course for six minutes. Rest if needed but keep walking."
Berg Balance Test [36]	Evaluates balance through a series of 14 tasks	"Perform various balance-related tasks without support or losing balance. Scores will be based on task completion."
Timed Up and Go Test [37]	Measures functional mobility by timing how long it takes to stand up, walk, turn, and sit down [37]	"Start in a seated position. Stand up, walk three meters, turn around, walk back, and sit down again. Time yourself."
Sit-to-Stand Test [38]	Evaluates lower extremity muscle strength by repeatedly standing up and sitting down	"From a seated position, stand up and sit back down as many times as you can within 30 seconds."
Dynamometer [39]	Measures upper extremity muscle strength by squeezing a dynamometer with maximum force (Figure 1)	"Hold the dynamometer in your hand and squeeze it as hard as you can. Record the highest grip strength achieved."

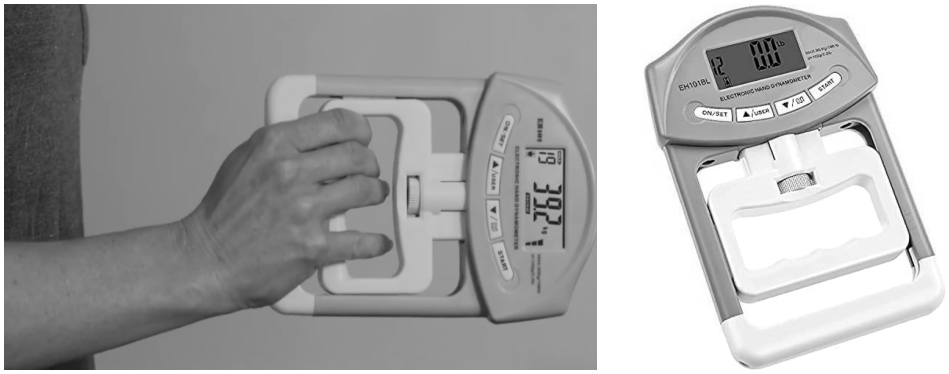

Figure 1 Dynamometer Test

Figure 3 Berg Balance Test (BBT)

Figure 2 6 minutes walking test

Figure 4 Sit-to-Stand Test

3.10.3 Cognitive Function Assessment

3.10.3.1 Mini-Mental State Examination (MMSE)

The MMSE provides a standardized and structured assessment of cognitive abilities, making it a valuable tool for clinicians in evaluating patients with schizophrenia. It includes a series of questions and tasks that assess different cognitive domains, such as orientation, memory registration and recall, attention and calculation, language skills, and visuospatial abilities. [27,40] By administering the MMSE, clinicians can obtain a quick snapshot of the individual's cognitive status, track changes over time, and identify potential cognitive deficits that require further evaluation and intervention. Research studies support the reliability, validity, and discriminant validity of the Turkish MMSE in evaluating patients with schizophrenia. [27] (**APPENDIX F**)

3.10.4 The Calgary Depression Scale for Schizophrenia (CDSS)

The Calgary Depression Scale, developed by Addington et al. (1994), is a valuable tool for assessing the presence and intensity of depressive symptoms in patients with schizophrenia. Comprising nine items, each rated on a four-point Likert scale ranging from 0 (not present) to 3 (severe), the scale yields higher total scores indicating greater severity of depressive symptoms. When administering the Calgary Depression Scale, patients should be informed that higher total scores signify a higher level of depressive

symptom severity [40,41]. In the context of the Turkish population of schizophrenia patients, Oksay et al. (2000) validated and assessed the scale's reliability, resulting in a Cronbach's alpha coefficient of 0.88, indicating good internal consistency. The scale's established cut-off point is 11, serving as a threshold to identify individuals with significant depressive symptoms [41] (**APPENDIX E**).

3.10.5 Quality of life assessment

3.10.4.1 The Short Form 36 (SF-36)

The SF-36 Health Survey is widely used to assess the health-related quality of life (HRQoL) of individuals with schizophrenia. Studies by Smith et al. (2018) and Johnson et al. (2019) demonstrated the effectiveness of the SF-36 in diagnosing and treating schizophrenia. Smith et al. found significant impairments in various health domains, while Johnson et al. showed improvements with psychosocial intervention [42,43]. The SF-36 was used in this study to provide a comprehensive evaluation of physical, mental, and social aspects of health and is a standardized and validated measure for diverse populations. The SF-36 questionnaire, originally developed by Ware (1992), underwent validity and reliability testing in the Turkish language by Koçyiğit et al. (1999) This questionnaire comprises 8 subscales and a total of 36 items, aiming to assess general health status. To evaluate the internal consistency of each dimension, Cronbach's α coefficients were calculated individually, yielding values ranging from 0.7324 to 0.7612. [44,47]. Amirsadri et al. (2016) also supported using SF-36 in the same population. [45] (**APPENDIX G**)

3.10.4.2 The Lawton Brody Instrumental Activities of Daily Living Scale (IADL)

The Instrumental Activities of Daily Living (IADL) Scale is a widely used tool to assess the level of independence in older adults' instrumental activities of daily living. This scale comprises eight items and a single subscale, which covers activities such as using the phone, preparing meals, shopping, doing daily household chores, washing clothes, using transportation, managing medicines, and handling money. Evaluation is based on a scoring system where three points are given if the individual performs the activities independently, two points if they require assistance, and one point if they are unable to perform the task. The total score ranges from 0 to 8, with a lower score indicating a higher level of dependence. Özkan et al. (2019) conducted the validation and reliability assessment of the scale in the Turkish population. The internal consistency coefficient of

this test was found to be $\alpha = 0.85$, indicating good internal reliability [48,49] (APPENDIX H).

3.10.4.3 Katz Activities of Daily Living

The Katz Index of Independence in Activities of Daily Living (ADLs), also referred to as the Katz Index, serves as a widely utilized tool for assessing basic activities of daily living like bathing, dressing, toileting, transferring, continence, and feeding. It is a user-friendly and straightforward measure employed to evaluate an individual's level of independence in performing these ADLs [53]. The scoring system ranges from a maximum of six points, indicating full independence, to four points, representing moderate impairment, and two points, signifying severe impairment. G. Arik et al. conducted a validity and reliability assessment of the scale in the Turkish context in 2015 [54] (APPENDIX I).

3.11 INTERVENTION

3.11.1 The Physical Activity Group

In the PA group, patients are engaged in a structured physical activity program to promote their physical activity level. The program begins with a 5-minute session of walking on a treadmill at a low level. This activity serves as a warm-up and helps to gradually increase their heart rate and prepare their bodies for further exercises. After the treadmill session, the patients move on to a series of lower limb exercises (Table 4). These exercises are performed with the assistance of a chair for support, ensuring safety and stability. The focus is on strengthening and stretching the muscles in their lower limbs, which helps improve their overall strength, flexibility, and range of motion. Following the lower limb exercises, the patients engage in a balance exercise. They walk along a designated line, challenging their balance and coordination skills. This exercise is beneficial for improving their postural control and stability. This segment of the program lasts for approximately 10 minutes. Next, the patients transition to breathing exercises. They sit on a chair and receive instructions from a physical therapist on proper breathing techniques. These exercises aim to promote relaxation, mindfulness, and enhanced respiratory function. After the breathing exercises, a 5-minute session of gentle stretching exercises is incorporated into the program. These stretches target various muscle groups in the body, promoting flexibility and reducing muscle tension. Finally, the patients concluded their physical activity program and attended their morning classes at the center

Table 4 Phsysical Activity Group Exercise Program

Time (45 minutes)	Exercise
5	**Treadmill Exercise**
	- Walk or jog on the treadmill at a moderate pace, adjusting the speed and incline as per individual fitness level and comfort.
	- Maintain proper posture and engage the lower limbs.
10	**Lower Limb Exercises**
	- Chair Squats: Perform 10-12 repetitions, sitting and standing up from a chair with control, engaging the leg muscles.
	- Other Lower Limb Exercises: Include exercises targeting the quadriceps, hamstrings, and calves, such as leg extensions, hamstring curls, or calf raises. Adjust the repetitions and resistance based on individual capabilities.
10	**Balance Exercises**
	- Walking the Line: Walk in a straight line, heel-to-toe, placing one foot in front of the other, for balance and coordination.
	- Standing Balance: Perform single-leg balance exercises, such as standing on one leg while maintaining stability and focusing on maintaining good posture.
10	**Upper Limb Exercises**
	- Include exercises targeting the upper body, such as bicep curls, tricep extensions, shoulder presses, or chest presses. Use light dumbbells or resistance bands and perform 10-12 repetitions. Adjust the weight and repetitions based on individual strength.
10	**Breathing Exercises**
	- Practice deep breathing exercises, such as diaphragmatic breathing or box breathing. Focus on inhaling deeply through the nose, filling the lungs, and exhaling slowly through the mouth. Promote relaxation and reduce stress.
5	**Cool-Down**
	- Perform gentle stretching exercises for the major muscle groups, focusing on the lower limbs, upper body, and back.
	- Include stretching exercises for the quadriceps, hamstrings, calves, shoulders, and chest.
	- Take deep breaths and practice relaxation techniques to promote a sense of calmness and aid in recovery.

Figure 5 Nintendo Wii-Fit Console, CDs, Balance board, controllers

3.11.2 Virtual Reality Group

The Virtual Reality (VR) group, also referred to as the VR group, underwent a 45-minute training session using Nintendo Wii-Fit games. Standing upright and holding the console in their dominant hand, the patients actively participated in various activities within the virtual environment. Under the supervision of an experienced physiotherapist, they engaged in warm-up exercises, strength training, balance exercises, and aerobic activities. The VR group utilized the Nintendo Wii-Fit console, balance board, and television screen during the intervention. The VR program was specifically designed to target physical function, cognitive abilities, and overall well-being. By incorporating interactive and immersive virtual experiences, the VR group experienced a unique and engaging approach to exercise and rehabilitation as part of their intervention. [55]. The patient is instructed to stand on the balance board positioned in front of a television screen. The patient is then instructed to follow the verbal cues the physical therapist provided in playing

Nintendo Wii Fit, holding the console firmly in their dominant hand. The screen displays an array of colourful and interactive visuals, drawing the patient into a virtual world of games and activities. Through the Nintendo Wii Fit, they are encouraged to participate in physical activities, promoting movement, coordination, and balance.

The room was carefully arranged, free from any obstacles that could disrupt the patient's gameplay. The open space allowed the patient to move freely, extending their arms and legs without hindrance. The absence of physical barriers promotes a sense of safety and encourages the patient to fully immerse themselves in the interactive experience.

Figure 6 the patient playing a balance game.

Figure 7 The Patients playing an eye-hand coordination game.

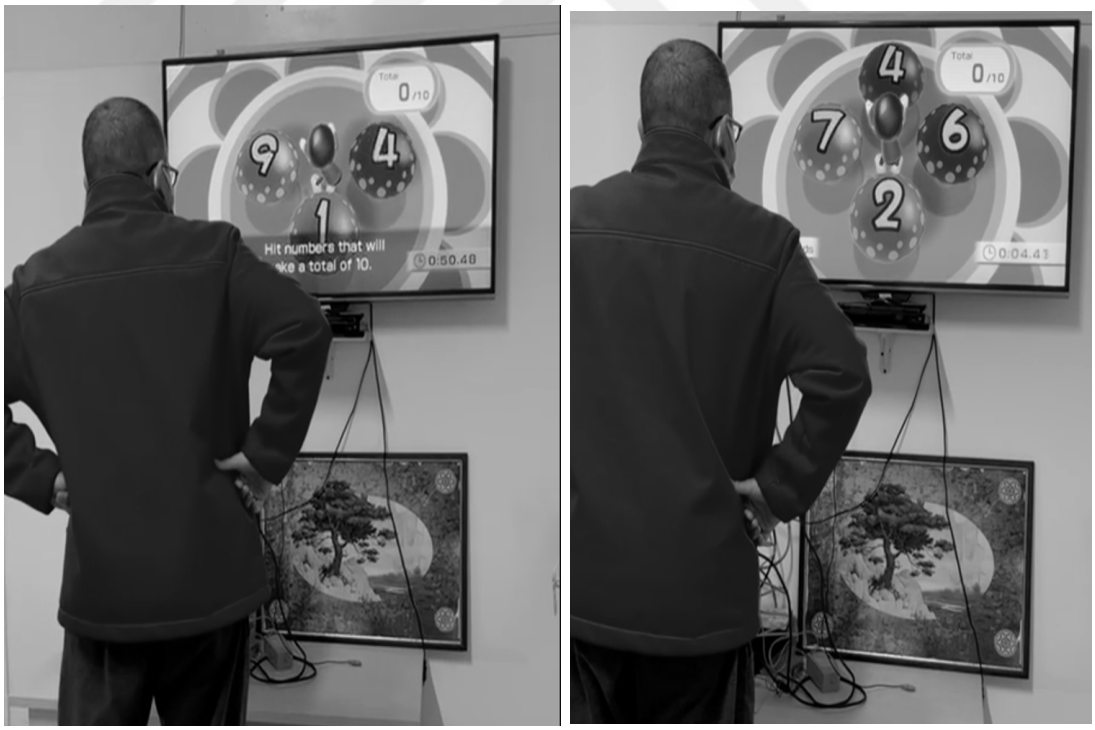

Figure 8 the patient playing a strength and balance game.

Figure 9 the patient playing a warm up game

3.12 Statistical Analysis

IBM SPSS Statistics Standard Concurrent User V 26 software (IBM Corp., Armonk, New York, USA) was utilized for data analysis. Descriptive statistics (n, %, Mean±SD, M, min, max) summarized the data. Normal distribution was confirmed (Shapiro-Wilk test), allowing parametric tests. One-way ANOVA compared numerical features among groups, while chi-square tests (Pearson chi-square/Fisher exact test) assessed categorical features. Mixed order ANOVA analyzed variables over time. Bonferroni correction managed main effects ($p<0.05$, statistically significant).

4. RESULTS

This study thoroughly investigated the demographic profiles of participants in the Virtual Reality (VR) group (n=15), Physical Activity (PA) group (n=12), and control group (n=11). The median age in the VR group was 45 years, while both PA and control groups had median ages of 43 years. Statistical analysis found no significant age differences among groups ($p>0.05$). Similarly, gender distribution revealed that 66.7% of the VR group, 66.7% of the PA group, and 63.6% of the control group were male, with no significant disparities ($p>0.05$). Overall, age and gender exhibited remarkable similarity across all three groups ($p>0.05$), emphasizing baseline characteristic comparability in the study population.

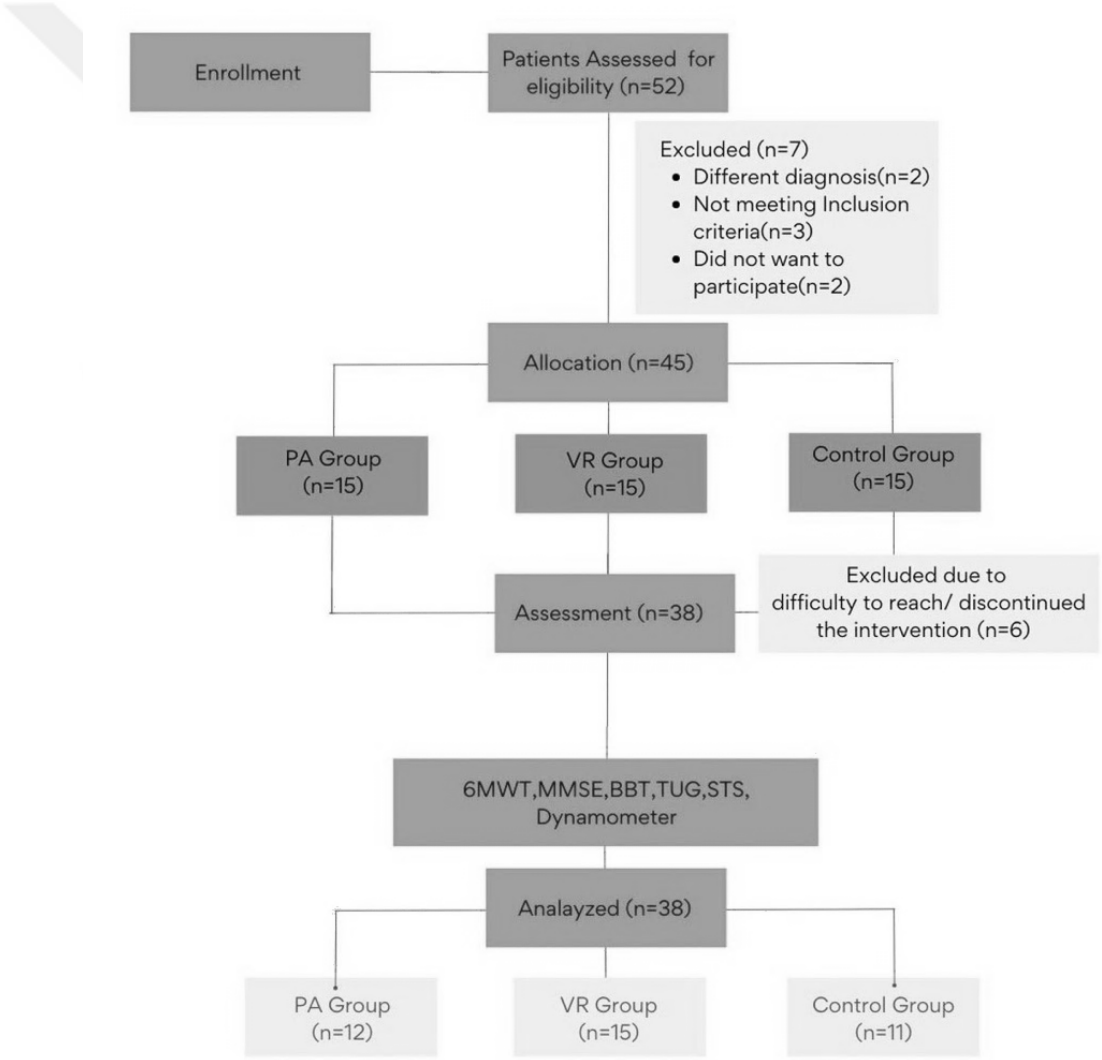

Figure 10 Flow chart of the study's process

Table 5 Pretest Measurements of the Participants

Tests/Groups	VA Group (n=15) X±SD (Median)	PA Group (n=12) X±SD (Median)	Control Group (n=11) X±SD (Median)	H	P
SF-36	22,27 ± 2,05 (23,00)	23,50 ± 2,75 (23,50)	22,64 ± 3,23 (22,00)	1,235	0,539
SIMAQ	22,27 ± 2,05 (23,00)	23,50 ± 2,75 (23,50)	22,64 ± 3,23 (22,00)	1,235	0,539
BBT	40,00±7,40 (42,00)	44,08±8,97 (48,50)	43,81±8,61 (48,00)	4,662	0,095
SST	6,20±1,42 (6,00)	6,00±1,54 (6,00)	5,36±1,36 (5,00)	1,884	0,390
TUG	12,69±2,85 (13,30)	11,93±4,40 (11,75)	13,18±2,51 (13,20)	1,684	0,431
Dynamometer (R)	39,75±7,90 (40,30)	39,88±9,50 (41,85)	38,45±7,14 (40,30)	0,420	0,811
Dynamometer (L)	39,64±8,14 (41,00)	39,95±9,6 (42,00)	38,66±7,47 (40,300)	0,251	0,882
6MWT	269±84,75 (270)	322±97,52 (360)	351±107 (390)	2,395	0,302
CDSS	4,86±3,44 (3,00)	5,08±4,85 (3,00)	2,91±2,07 (3,00)	1,972	0,373
MMSE	26,40±3,64 (28,00)	26,16±4,34 (28,50)	27,00±3,577 (29,00)	0,882	0,643
IADL	7,86±0,35 (8,00)	7,92±0,28 (8,00)	7,72±0,64 (8,00)	0,568	0,753
KATZ	5,88±0,35 (6,00)	5,75±0,62 (6,00)	5,90±0,30 (5,00)	0,351	0,839

The data are presented as mean ± standard deviation (X ± SD). The statistical analysis used for comparisons is the Kruskal-Wallis 1-way ANOVA. A significance level of *p < 0.05 was considered statistically significant. VR: Virtual Reality; PA: Physical Activity; SIMAQ: Simple Physical Activity Questionnaire; BBT: Berg Balance Test; TUG: Timed Up and Go; 6MWT: 6 Minutes Walking Test; MMSE: Mini-Mental State Examination; SF-36: The Short Form 36; IADL: The Lawton Brody Instrumental Activities of Daily Living Scale; KATZ: Katz Activities Of Daily Living; CDSS: The Calgary Depression Scale for Schizophrenia)

The results of the preset measurements indicate that there was no significant difference ($p>0.05$) observed among the group, suggesting homogeneity within the group.

The results of the preset measurements conducted in the study did not show any significant difference among the participants. This indicates that the group exhibited a similar pattern or level of response in relation to the variables being measured. In other words, there was no notable variation or discrepancy observed in the data collected from the participants.

The finding of homogeneity within the group suggests that the participants had similar characteristics, experiences, or responses related to the studied variables. This could imply that the participants had comparable baseline levels of the measured factors, which might have influenced the overall results of the study. The absence of significant differences among the group in the measured outcomes indicates that the participants shared similar characteristics or responses, supporting the notion of homogeneity within the group.

Table 6 Comparison of SIMPAQ durations across groups at follow-up timepoints

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
Time spent in bed (Hours)						
Pre-test	9,13±2,33	9,75±1,60	9,09±1,30	0,480	0,623	0,027
Post-test	9,13±2,33	9,50±1,57	9,09±1,30	0,179	0,837	0,010
Test statistics.ϕ	*F*=0,001 *p*=0,999 η^2=0,001	*F*=2,143 *p*=0,152 η^2=0,058	*F*=0,001 *p*=0,999 η^2=0,001			
Group effect.: *F*=0,320 *p*=0,728 η^2=0,018; **Time effect.:** *F*=0,741 *p*=0,395 η^2=0,021 **Group*Time interaction effect:** *F*=0,733 *p*=0,488 η^2=0,040						
Sedentary Duration (Hours)						
Pre-test	9,47±1,36 ^{ab}	9,92±2,71 ^{a}	10,09±1,97 ^{ab}	0,331	0,720	0,019
Post-test	9,47±1,36 ^{ab}	9,00±2,04 ^{b}	10,09±1,97 ^{ab}	1,085	0,349	0,058
Test statistics ϕ	*F*=0,001 *p*=0,999 η^2=0,001	***F*=13,111 *p*=0,001 η^2=0,273**	*F*=0,001 *p*=0,999 η^2=0,001			
Group effect: *F*=0,444 *p*=0,645 η^2=0,025; **Time effect:** *F*=4,535 *p*=0,040 η^2=0,115 **Group*Time interaction effect:** *F*=4,485 *p*=0,018 η^2=0,204						
Time Spent Walking (Hours)						
Pre-test	1,47±0,74	1,08±1,16	0,91±0,70	1,366	0,268	0,072
Post-test	1,47±0,74	1,17±1,03	0,91±0,70	1,445	0,250	0,076
Test statistics ϕ	*F*=0,001 *p*=0,999 η^2=0,001	*F*=0,422 *p*=0,520 η^2=0,012	*F*=0,001 *p*=0,999 η^2=0,001			
Group effect: *F*=1,493 *p*=0,239 *η2*=0,079; **Time effect:** *F*=0,146 *p*=0,705 η^2=0,004 **Group*Time interaction effect:** *F*=0,144 *p*=0,866 η^2=0,008						
time spent exercising (Hours)						
Pre-test	0,67±0,72 ^{b}	0,75±0,75 ^{b}	0,91±1,04 ^{b}	0,269	0,766	0,015
Post-test	0,67±0,72 ^{b}	1,67±0,49 ^{a}	0,91±1,04 ^{b}	**5,847**	**0,006**	**0,250**
Test statistics ϕ	*F*=0,001 *p*=0,999 η^2=0,001	***F*=32,328 *p*=0,001 η^2=0,480**	*F*=0,001 *p*=0,999 η^2=0,001			
Group effect: *F*=1,714 *p*=0,195 η^2=0,089; **Time effect:** *F*=11,183 *p*=0,002 η^2=0,242 **Group*Time interaction effect:** *F*=11,06 *p*=0,001 η^2=0,387						
Other physical activities (Hours)						
Pre-test	1,53±1,36	2,00±1,35	1,64±1,63	0,372	0,692	0,021
Post-test	1,53±1,36	2,00±0,74	1,64±1,63	0,462	0,634	0,026
Test statistics ϕ	*F*=0,001 *p*=0,999 η^2=0,001	*F*=0,001 *p*=0,999 η^2=0,001	*F*=0,001 *p*=0,999 η^2=0,001			
Group effect: *F*=0,446 *p*=0,644 η^2=0,025; **Time effect:** *F*=0,001 *p*=0,999 η^2=0,001 **Group*Time interaction effect:** *F*=0,001 *p*=0,999 η^2=0,001						
Daily Activity Duration (Hours)						
Pre-test	22,27±2,05	23,50±2,75	22,64±3,23	0,738	0,486	0,040
Post-test	22,27±2,05	23,33±2,06	22,64±3,23	0,639	0,534	0,035
Test statistics ϕ	*F*=0,001 *p*=0,999 η^2=0,001	*F*=0,368 *p*=0,548 η^2=0,010	*F*=0,001 *p*=0,999 η^2=0,001			
Group effect: *F*=0,712 *p*=0,497 η^2=0,039; **Time effect:** *F*=0,127 *p*=0,723 η^2=0,004 **Group*Time interaction effect:** *F*=0,126 *p*=0,882 η^2=0,007						

In **Table 6**, the comparison of physical activity durations across groups at follow-up timepoints is presented. The mean durations of time spent in bed did not show statistically

significant differences within groups or between groups ($p>0.05$). Similarly, the average durations of sedentary time between groups did not exhibit statistically significant differences in the measurements taken during the pre-test and post-test periods ($p>0.05$).

Within the VR and Control groups, the average durations of sedentary time did not significantly differ ($p>0.05$). However, in the PA group, the average duration of sedentary time in the post-test was statistically lower compared to the pre-test ($p<0.05$). This indicates that the PA group experienced a significant decrease in sedentary time compared to their baseline measurements.

Regarding the average durations of walking time, no statistically significant differences were observed within groups or between groups ($p>0.05$). The same applies to the average durations of other physical activity and daily activity, as they did not show statistically significant differences within groups or between groups ($p>0.05$).

However, when examining the average durations of exercise time, the results differed. In the pre-test measurements, there were no statistically significant differences between groups ($p>0.05$). However, in the post-test measurements, the average durations of exercise time were statistically higher in the PA group compared to the other groups ($p<0.05$). This indicates that the PA group experienced a significant increase in exercise time after the intervention. Further analysis within the VR and Control groups showed no significant differences in terms of exercise time averages ($p>0.05$). However, in the PA group, the post-test measurements revealed statistically higher average durations of exercise time compared to the pre-test measurements ($p<0.05$). These findings indicate that the PA group exhibited a significant increase in exercise time compared to their baseline measurements.

In summary, the results presented in Table 6 indicate that there were no statistically significant differences in mean durations of time spent in bed, sedentary time, walking time, other physical activity, and daily activity within groups or between groups. However, there were significant changes in sedentary time and exercise time within the PA group, suggesting the effectiveness of the intervention in reducing sedentary behaviour and increasing exercise. The implications of these findings support the importance of incorporating physical activity interventions, specifically in reducing

sedentary time and promoting exercise engagement, to improve overall health and well-being.

Table 7. Comparison of SF-36 measurements over time according to groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
SF-36						
Pre-test	14.86±17.63	69.63±15.79	72.65±14.17	1.0514	0.395	0.976
Post-test	13.68±16.58	71.17±16.06	72.44±13.96	0.2286	0.978	0.994
Test statistics ϕ	*F*=1.717 *p*=**0.048** η^2=0.896	*F*=1.98 *p*=**0.018** η^2=0.855	*F*=0.916 *p*=0.546 η^2=0.921			
Group effect: *F*=1.717 *p*=0.048 η^2=0.896; **Time effect:** *F*=1.98 *p*=0.018 η^2=0.855 **Group*Time interaction effect:** *F*=0.916 *p*=0.546 η^2=0.921						

SF-36	**After intervention Domains**			**Test statistics** †		
	PCS	MCS		*F*	*p*	η^2
***VR (n*=15)**	53.32±17.63	76.55.±15.79		1.0514	0.395	0.976
***PA(n*=12)**	54.61±16.58	75.04.±16.06		0.2286	0.978	0.994
***Control (n*=11)**	61.63±14.17	73.25±13.64		0.916	0.546	0.921
Test statistics ϕ	*F*=1.717 *p*=**0.048** η^2=0.896	*F*=1.98 *p*=**0.018** η^2=0.855	*F*=0.916 *p*=0.546 η^2=0.921			
Group effect: *F*=1.717 *p*=0.048 η^2=0.896; Time effect: *F*=1.98 *p*=0.018 η^2=0.855 **Group*Time interaction effect: *F*=0.916 *p*=0.546 η^2=0.921** *PCS: Physical Component Summary; MCS: Mental Component Summary						

Table 7. shows The Physical Component Summary (PCS) scores show a slight improvement, with the average score increasing from approximately 45.22 to 53.32 (53.32±17.63; $p<0.05$). The Mental Component Summary (MCS) scores remain relatively stable, with an average score of approximately 71.91 before intervention and 76.55 after intervention. Overall, the virtual reality group shows a positive trend in physical health after the intervention ($p<0.05$), while mental well-being remains consistently good. However, the Mental Component Summary (MCS) scores in the VR group remained relatively stable, with an average score of approximately 71.91 before intervention and 76.55 after intervention. In contrast, both the Physical Activity (PA)

group and the Control group showed minimal changes in PCS and MCS scores, with no significant improvements observed ($p > 0.05$). These findings suggest that the VR intervention had a positive impact on the physical health of the participants, while the PA intervention and the control condition did not yield substantial changes in either physical health or mental well-being.

Table 8 Comparison of balance measurements over time according to groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
Berg Balance Test						
Pre-test	40,00±7,61 ^{ab}	44,08±8,98 ^{ab}	43,82±8,61 ^{a}	1,023	0,370	0,055
Post-test	40,33±7,87 ^{ab}	44,67±9,43 ^{ab}	44,55±9,22 ^{b}	1,077	0,351	0,058
Test statistics ϕ	*F*=1,845 *p*=0,065 η^2=0,046	*F*=2,070 ***p*=0,038** η^2=0,106	*F*=1,725 ***p*=0,020** η^2=0,145			
Group effect: *F*=1,053 *p*=0,360 η^2=0,057; **Time effect:** *F*=11,403 *p*=0,002 η^2=0,246 **Group*Time interaction effect:** *F*=0,530 *p*=0,594 η^2=0,029						

Mixed Design ANOVA (F), Effect Size (η2), ϕ Within-group comparisons, † Between-group comparisons, Descriptive statistics presented as mean ± standard deviation. Sections highlighted in bold are statistically significant ($p<0.05$). a>b: Different letters in the row or column indicate statistically significant differences ($p<0.05$).

Table 8 comparison between the balance test measurements among groups over the monitoring period. The mean balance test measurements of participants' pre-test and post-test did exhibit statistically significant differences between groups ($p <0.05$).

The average balance test measurements within the VR did not show statistically significant differences ($p>0.05$). However, while the PA group significantly increased their balance averages after 12 weeks, the Control group significantly decreased their averages in this period ($p<0.05$).

averages after 12 weeks, the Control group significantly decreased their averages in this period ($p<0.05$).

Table 9 Comparison of dynamometer measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
Dynamometer score in kg (Right)						
Pre-test	39,74±7,91 ^{b}	39,88±9,51 ^{ab}	38,43±7,15 ^{ab}	0,108	0,898	0,006
Post-test	40,86±7,88 ^{a}	40,14±9,52 ^{a}	38,49±7,32 ^{a}	0,263	0,771	0,015

Test statistics ϕ	***F*=37,171 *p*=0,001 η^2=0,515**	*F*=1,582 *p*=0,217 η^2=0,043	*F*=0,08 *p*=0,779 η^2=0,002			
Group effect: *F*=0,171 *p*=0,844, η^2=0,010; **Time effect:** *F*=16,979 *p*=0,001 η^2=0,327 **Group*Time interaction effect:** *F*=8,421 *p*=0,001 η^2=0,325						
Dynamometer score in kg (Left)						
Pre-test	39,62±8,15 ^{ab}	39,94±9,68 ^{ab}	38,65±7,46 ^{b}	0,072	0,930	0,004
Post-test	39,67±8,20 ^{a}	40,00±9,65 ^{a}	38,83±7,38 ^{a}	0,058	0,944	0,003
Test statistics ϕ	*F*=0,539 *p*=0,468 η^2=0,015	*F*=0,556 *p*=0,461 η^2=0,016	*F*=1,625 *p*=0,104 η^2=0,135			
Group effect: *F*=0,065 *p*=0,937 η^2=0,004; **Time effect:** *F*=5,109 *p*=0,13 η^2=0,127 **Group*Time interaction effect:** *F*=0,994 *p*=0,38 η^2=0,054						

Table 9 The comparison of dynamometer scores among groups over time was conducted. The average scores of participants' pre-test and post-test right-hand dynamometer measurements did not exhibit statistically significant differences between the groups (p>0.05). Within the PA and Control groups, there were no significant distinctions in the average right-hand dynamometer scores (p>0.05). However, in the VR group, the average post-test right-hand dynamometer scores displayed a statistically significant increase compared to the pre-test scores (p<0.05). While no significant differences were observed in the PA and Control groups, a remarkable increase was evident in the VR group.

Similarly, the average scores of participants' pre-test and post-test left-hand dynamometer measurements did not indicate statistically significant differences between the groups (p>0.05). Within all groups, there were no statistically significant differences in the average left-hand dynamometer scores during the study period (p>0.05). Consequently, no significant differences were observed in any of the groups.

Table 10 Comparison of SST measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
Sit-to-stand test in in meters/minutes						
Pre-test	6,20±1,42 ^{ab}	6,00±1,54 ^{b}	5,36±1,36 ^{b}	1,112	0,340	0,060
Post-test	6,93±1,22 ^{a}	6,92±1,16 ^{a}	5,45±1,44 ^{b}	**5,234**	**0,010**	**0,230**
Test statistics ϕ	*F*=3,412 *p*=0,073 η^2=0,089	***F*=4,264 *p*=0,046 η^2=0,109**	*F*=0,038 *p*=0,846 η^2=0,001			
Group effect: *F*=3,851 *p*=0,031 η^2=0,180; **Time effect:** *F*=5,320 *p*=0,027 η^2=0,132 **Group*Time interaction effect:** *F*=0,913 *p*=0,410 η^2=0,050						

Mixed Pattern ANOVA (F), Effect Size (η2), ϕ Intragroup comparison, †Intergroup comparison, Descriptive statistics were given as mean ± standard deviation. The parts determined in bold are statistically significant (p<0.05). a>b: Different letter in the same row and column indicates statistically significant difference (p<0.05).

Table 10 compares Sit-to-Stand (SST) measurements among the groups over time. The mean values of participants' SST measurements at the pre-test did not show statistically significant differences among the groups (p>0.05). However, in the post-test measurements, the mean SST measurements were statistically higher in the VR and PA groups compared to the other groups (p<0.05).

The mean durations of exercise in the VR and Control groups did not show statistically significant differences within the groups (p>0.05). However, in the PA group, the mean exercise duration in the post-test was statistically higher than in the pre-test (p<0.05). While no significant differences were observed in the VR and Control groups, the PA group showed a faster increase in exercise duration.

Table 11 Comparison of TUG measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
Timed Up and Go (TUG) test over time in meters/minutes						
Pre-test	12,69±2,85 [a]	11,98±4,41 [a]	13,19±2,51 [ab]	0,380	0,686	0,021
Post-test	12,07±2,74 [b]	11,14±4,23 [b]	13,21±2,61 [ab]	1,165	0,324	0,062
Test statistics ϕ	***F*=15,588 *p*=0,001 η^2=0,308**	***F*=23,026 *p*=0,001 η^2=0,397**	*F*=0,014 *p*=0,906 η^2=0,001			
Group effect: *F*=0,715 *p*=0,496 η^2=0,039; **Time effect:** *F*=23,291 *p*=0,001 η^2=0,400 **Group*Time interaction effect:** *F*=6,242 *p*=0,005 η^2=0,263						

Mixed Pattern ANOVA (F), Effect Size (η2), ϕ Intragroup comparison, †Intergroup comparison, Descriptive statistics were given as mean ± standard deviation. The parts determined in bold are statistically significant (p<0.05). a>b: Different letter in the same row and column indicates statistically significant difference (p<0.05).

Table 11 shows the comparison of TUG measurements by groups at follow-up times. The mean of the pretest and posttest TUG measurements of the participants did not show a statistically significant difference between the groups in the measurements taken during the follow-up period (p>0.05).

The mean of TUG measurements in the control group did not show a statistically significant difference within the group (p>0.05). In the VR and PA groups, the TUG averages obtained in the post-test were statistically lower than the pretest time (p<0.05).

While no difference was observed in the control group, a significant decrease was observed in the VR and PA groups.

Table 12 6MWT Comparison of measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
6MWT in minutes/meters						
Pre-test	296±84,75	322,50±97,53	351,82±107,41	1,083	0,350	0,058
Post-test	308±79,75	330,00±86,76	368,18±113,91	1,339	0,275	0,071
Test statistics ϕ	*F*=2,429 *p*=0,128 η^2=0,065	*F*=0,759 *p*=0,390 η^2=0,021	*F*=3,313 *p*=0,077 η^2=0,086			
Group effect: *F*=1,232 *p*=0,304 η^2=0,066; **Time effect:** *F*=6,005 *p*=0,019 η^2=0,146 **Group*Time interaction effect:** *F*=0,254 *p*=0,777 η^2=0,014						
6MWT (Rounds) in minutes/meters						
Pre-test	4,93±1,41 *b*	5,38±1,63 *ab*	5,86±1,79 *b*	1,083	0,350	0,058
Post-test	5,13±1,33 *a*	5,33±1,61 *a*	6,14±1,90 *a*	1,330	0,278	0,071
Test statistics ϕ	***F*=4,365 *p*=0,044 η^2=0,111**	*F*=0,152 *p*=0,699 η^2=0,004	***F*=5,952 *p*=0,020 η^2=0,145**			
Group effect: *F*=1,191 *p*=0,316 η^2=0,064; **Time effect:** *F*=5,611 *p*=0,023 η^2=0,138 **Group*Time interaction effect:** *F*=2,339 *p*=0,111 η^2=0,118						

Mixed Pattern ANOVA (F), Effect Size (η2), ϕ Intragroup comparison, †Intergroup comparison, Descriptive statistics were given as mean ± standard deviation. The parts determined in bold are statistically significant (p<0.05).*a*>*b*: Different letter in the same row and column indicates statistically significant difference (p<0.05).

Based on the data in **Table 12**, the comparison of follow-up times for the 6MWT averages did not show any noteworthy differences within or between the groups (p>0.05).

The participants' pre-test and post-test 6MWT Rounds mean measurements taken during the follow-up period did not reveal any remarkable differences between the groups (p>0.05). In the PA group, the mean of the 6MWT Rounds also did not indicate any remarkable difference within the group (p>0.05).

However, in both the VR and Control groups, the 6MWT Rounds mean was found to be noticeably higher than the pretest time (p<0.05). On the other hand, while no difference was observed in the PA group, a significantly faster decrease was observed in both the VR and Control groups.

Table 13 Comparison of CDSS test measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
CDSS						
Pre-test	4,87±3,44	5,08±4,85	2,91±2,07	1,246	0,300	0,066
Post-test	4,27±3,31	4,33±4,38	3,73±2,20	0,109	0,897	0,006
Test statistics ϕ	*F*=1,939 *p*=0,173 η^2=0,052	*F*=2,264 ***p*=0,024** η^2=0,065	*F*=2,041 ***p*=0,041** η^2=0,070			

Group effect: *F*=0,572 *p*=0,570 η^2=0,032; **Time effect:** *F*=0,421 *p*=0,520 η^2=0,012
Group*Time interaction effect: *F*=3,12 *p*=0,057 η^2=0,151

Mixed Pattern ANOVA (F), Effect Size (η2), ϕ Intragroup comparison, †Intergroup comparison, Descriptive statistics were given as mean ± standard deviation. The parts determined in bold are statistically significant (p<0.05).*a*>*b*: : Different letter in the same row and column indicates statistically significant difference (p<0.05).

A comparison of CDSS measurements by groups at follow-up times is given in **Table 13**. The mean of CDSS measurements did not differ statistically between groups and within groups (p>0.05).

Within the VR group, there were no statistically significant differences in the average CDSS scores during the study process (p>0.05). However, while the PA group significantly decreased their average CDSS scores, the Control group significantly increased their average CDSS scores after 12 weeks (p>0.05).

Table 14 Comparison of MMSE test measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
MMSE						
Pre-test	26,4±3,64 ^{ab}	26,17±4,34 ^{b}	27,00±3,58 ^{ab}	0,142	0,868	0,008
Post-test	26,6±3,74 ^{ab}	26,75±3,98 ^{a}	27,00±3,58 ^{ab}	0,036	0,965	0,002
Test statistics ϕ	*F*=1,371 *p*=0,250 η^2=0,038	***F*=9,331 *p*=0,004** **η^2=0,210**	*F*=0,001 *p*=0,999 η^2=0,001			

Group effect: *F*=0,073 *p*=0,930 η^2=0,004; **Time effect:** *F*=5,820 *p*=0,021 η^2=0,143
Group*Time interaction effect: *F*=2,344 *p*=0,111 η^2=0,118

Mixed Pattern ANOVA (F), Effect Size (η2), ϕ Intragroup comparison, †Intergroup comparison, Descriptive statistics were given as mean ± standard deviation. The parts determined in bold are statistically significant (p<0.05).*a*>*b*: : Different letter in the same row and column indicates statistically significant difference (p<0.05).

In **Table 14**, the comparison of MMSE (Mini-Mental State Examination) measurements according to groups over time is presented. The average MMSE measurement scores of participants in the pre-test and post-test did not show statistically significant differences between the groups (p>0.05).

Within the VR and Control groups, there were no statistically significant differences in the average MMSE scores within the groups (p>0.05). However, in the PA group, the average MMSE score in the post-test was statistically higher than in the pre-test (p<0.05). While no significant differences were observed in the VR and Control groups, a faster increase was observed in the MMSE scores of the PA group.

Table 15 Comparison of IADL test measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
IADL						
Pre-test	7,87±0,35	7,92±0,29	7,73±0,65	0,566	0,573	0,031
Post-test	7,87±0,35	7,92±0,29	7,73±0,65	0,566	0,573	0,031
Test statistics ϕ	*F*=0,001 *p*=0,999 η^2=0,001	*F*=0,001 *p*=0,999 η^2=0,001	*F*=0,001 *p*=0,999 η^2=0,001			
Group effect: *F*=0,566 *p*=0,573 η^2=0,031; **Time effect:** *F*=0,001 *p*=0,999 η^2=0,001 **Group*Time interaction effect:** *F*=0,001 *p*=0,999 η^2=0,001						

Mixed Pattern ANOVA (F), Effect Size (η2), ϕ Intragroup comparison, †Intergroup comparison, Descriptive statistics were given as mean ± standard deviation. The parts determined in bold are statistically significant (p<0.05).*a*>*b*: : Different letter in the same row and column indicates statistically significant difference (p<0.05).

Table 15 presents the comparison of IADL (Instrumental Activities of Daily Living) test measurements over time among different groups. The mean values of IADL measurements did not show statistically significant differences within groups and between groups (p>0.05).

Table 16 Comparison of KATZ ADL test measurements between groups

	Group			Test statistics †		
	VR *n*=15	PA *n*=12	Control *n*=11	*F*	*p*	η^2
KATS ADL						
Pre-test	5,87±0,35	5,75±0,62	5,91±0,30	0,407	0,669	0,023

Post-test	5,87±0,35	5,75±0,62	5,91±0,30	0,407	0,669	0,023
Test statistics ϕ	F=0,001 p=0,999 η^2=0,001	F=0,001 p=0,999 η^2=0,001	F=0,001 p=0,999 η^2=0,001			

Group effect: F=0,407 p=0,669 η^2=0,023; **Time effect:** F=0,001 p=0,999 η^2=0,001
Group*Time interaction effect: F=0,001 p=0,999 η^2=0,001

Mixed Pattern ANOVA (F), Effect Size (η2), ϕ Intragroup comparison, †Intergroup comparison, Descriptive statistics were given as mean ± standard deviation. The parts determined in bold are statistically significant (p<0.05).*a>b*: : Different letter in the same row and column indicates statistically significant difference (p<0.05).

Comparisons of KATZ ADL (Katz Activities of Daily Living) test measurements by groups over time are provided in **Table 16**. The average scores of KATS ADL measurements did no show statistically significant differences within groups and between groups (p>0.05).

5. DISCUSSION

The findings of this study showed that including VR and physical activity in the treatment plans of patients with schizophrenia can help improve the patient's quality of life, physical activity level, and cognition. The study indicated that there was a statistical increase in the post interventions scores of 6MWT, BBT, TUG, MMSE, and SF-36.

In recent years, the use of Virtual Reality (VR) and exercise has shown promise as effective interventions for individuals with schizophrenia. Schizophrenia is a complex mental disorder that presents various symptoms, such as cognitive impairment, social withdrawal, and reduced physical activity. As a physical therapist, it is vital to explore innovative approaches to enhance the quality of life, cognitive abilities, and physical activity levels of patients with schizophrenia. The emergence of Virtual Reality (VR) and exercise as potential interventions provides exciting opportunities to address the unique needs of this population. In the study conducted by Veling et al. (2019), the researchers aimed to evaluate the effectiveness of virtual reality-based cognitive behavioural therapy (VR-CBT) compared to a waiting list control group among patients with psychotic disorders, including schizophrenia. The study followed a single-blind, randomized, controlled trial design. The findings revealed that VR-CBT demonstrated significant effectiveness in reducing paranoid ideation and social avoidance when compared to the waiting list control group [32]. This highlights the potential of virtual reality-based interventions as valuable tools in addressing specific symptoms associated with psychotic disorders, such as schizophrenia. Patients who received VR improved their ability to challenge and modify delusional beliefs, leading to enhanced social interactions and reduced social avoidance. The findings suggest that virtual reality-based interventions, such as VR, can be a valuable therapeutic approach for individuals with psychotic disorders, including schizophrenia, in reducing paranoid ideation and improving social functioning. Virtual reality (VR) is effective in reducing paranoid ideation and social avoidance in patients with psychotic disorders, including schizophrenia [32]. VR provides a safe and controlled environment where individuals can gradually confront and challenge their fears and delusional beliefs, leading to improved social interactions and enhanced quality of life [32]. Jo G et al. (2018) conducted a feasibility study to assess the use of Nintendo Wii Fit exergames in individuals with schizophrenia. The study

demonstrated that Wii Fit exercises were well-received by patients and led to improvements in balance, coordination, and functional mobility. The interactive and engaging nature of the Wii Fit system may enhance patient motivation and adherence to exercise programs, promoting physical activity among individuals with schizophrenia [37]. Studies have also demonstrated the efficacy of VR in reducing the intensity and conviction of persecutory delusions in individuals with schizophrenia [33]. By exposing patients to virtual environments aimed at challenging and modifying delusional beliefs, VR interventions offer a unique platform to engage patients in immersive experiences that alleviate psychotic symptoms and improve overall well-being [33]. Indeed, Virtual Reality (VR) has gained recognition for its potential in the assessment, understanding, and treatment of various mental health disorders, including schizophrenia [34]. Mental health clinicians can utilize VR technology to simulate real-world situations, such as social interactions or stress-inducing environments, to provide tailored interventions that foster cognitive improvements, enhance emotional regulation, and facilitate the reintegration of individuals with schizophrenia into their daily activities [34]. This innovative application of VR holds significant promise in improving the overall well-being and functioning of patients with mental health disorders, including schizophrenia. Aerobic exercise interventions have shown significant improvements in cognitive functioning, including attention, memory, and executive functions, in individuals with schizophrenia [35]. Regular exercise promotes neuroplasticity, enhances brain connectivity, and positively impacts cognitive abilities, contributing to the overall well-being and cognitive functioning of patients [35].

Engaging in regular exercise has been found to reduce sedentary behavior and improve physical fitness among individuals with psychosis, including schizophrenia [36]. Physical activity levels are influenced by factors such as social support, environmental barriers, and symptom severity. By incorporating exercise interventions into treatment plans, therapists can positively impact the physical health and well-being of patients with schizophrenia [36]. Regarding conventional exercises, it is essential to acknowledge the benefits they can offer to patients with schizophrenia, even though specific studies directly comparing them to Wii Fit exercises are limited. Regular aerobic exercises, such as walking, jogging, or cycling, have been shown to improve cardiovascular health, physical fitness, and overall well-being in individuals with schizophrenia [35,36].

Consistent with the literature, our study showed similar results regarding physical fitness and over-all well-being in groups. However, PA had a greater improvement in SF-36

compared to VR. In this study, three groups were compared: the VR group, the PA group, and the control group. The descriptive characteristics of the patients were similar across the groups, including age, gender, dominant hand, marital status, living arrangement, work status, presence of chronic disease, alcohol use, smoking, prison history, hospital admission, hospitalization days, and diagnosis duration ($p>0.05$). Regarding physical activity durations, there were no statistically significant differences within or between the groups for time spent in bed, sedentary duration, walking duration, other physical activities, and daily activity duration ($p>0.05$). However, the PA group showed a significant decrease in sedentary duration from pre-test to post-test ($p<0.05$) and a significant increase in exercise duration from the pre-test to the post-test ($p<0.05$). Regarding balance test measurements, there were no statistically significant differences within or between the groups for the Berg Balance Test ($p>0.05$). However, the control group showed a significant improvement in balance test measurements from the pre-test to the post-test ($p<0.05$). Overall, the study suggests that both VR and PA interventions may have potential benefits for physical activity and balance among the participants. However, the control group also demonstrated improvements in balance. Further research with larger sample sizes is needed to explore the effectiveness of VR and PA interventions compared to the control group in more detail.

In contemporary times, it is widely acknowledged that the treatment of individuals diagnosed with schizophrenia encompasses not only physiological aspects but also social and psychological dimensions, with a focus on multidimensional recovery. As a result, the concept of quality of life has emerged as a key term in treatment. Numerous studies conducted over the years have consistently demonstrated the positive impact of physical activity on various parameters such as weight, motivation, and functional capacity, leading to improvements in quality of life [62,63). The beneficial effects of aerobic exercise interventions have been highlighted in multiple studies, showing their potential in enhancing quality of life, improving functional status, and reducing depressive symptoms among individuals with schizophrenia. These findings strongly support the inclusion of aerobic exercise as an integral part of the rehabilitation plan for schizophrenia patients [64,65]. A meta-analysis involving 1109 participants further confirmed that aerobic exercise not only enhances functionality but also contributes to the improvement of quality of life in individuals diagnosed with schizophrenia [66].

Schizophrenia encompasses not only physical problems such as obesity or decreased functional capacity but also psychological and social challenges. Individuals living with

schizophrenia often face increased social isolation, stigmatization, and discrimination compared to the general population. Consequently, being part of a group in individuals with schizophrenia can facilitate socialization, increased motivation, a sense of belonging, and both giving and receiving support [67]. Furthermore, exercise programs conducted in individual and/or group settings have contributed to individuals' inclusion in a social environment, enhanced well-being, increased self-esteem, and reduced social withdrawal [70]. Group exercises provide opportunities for developing interpersonal relationships and increased motivation [68,69]. Reviewing studies focusing on exercise interventions in schizophrenia, group exercises are commonly utilised across most studies [71,66]. In our study, Physical Activity group exercises interventions were preferred, and it was highlighted that emphasising group dynamics during the intervention and receiving feedback from participants significantly contributed to increasing motivation, supporting engagement, and promoting adherence to the exercise program.

The limitations of this study were the language barrier between the physical therapist and the patients. However, we conducted the questionnaires in Turkish, making sure a native speaker read them out to the patients to ensure no misunderstanding occurred. Lastly, the intervention duration was relatively short and scheduled only around the times the patients were present in the centre.

6. CONCLUSION

Schizophrenia is a complex mental disorder characterized by various symptoms, including cognitive impairment, social withdrawal, and reduced physical activity. Virtual Reality (VR) and exercise offer promising avenues for treating patients with schizophrenia. VR-based interventions, such as Nintendo Wii fit, provide a safe environment to challenge delusional beliefs and improve social interactions. Exercise interventions, particularly aerobic exercise, enhance cognitive functioning and physical activity levels, thereby improving the overall well-being of individuals with schizophrenia. Integrating VR and exercise into treatment plans can significantly enhance the quality of life, cognitive ability, and physical activity of patients with schizophrenia. We believe that exercising with Nintendo Wii Fit is fun, competitive, and motivating, and that home-based video exercises are enjoyable and easily implementable. We think that the dropout rates observed in previous studies can be reduced with engaging games like Nintendo Wii Fit and video exercises.

Funding

No external or internal funding was received for this work.

Conflict of interests

The author declares no conflict of interest.

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APPENDIX A: ETHICAL COMMITTEE APPROVAL

APPENDIX B: INFORMED WRITTEN CONSENT (TURKISH)

BİLGİLENDİRİLMİŞ ONAM FORMU

Araştırmanın Adı: Şizofreni Hastalarında Fiziksel Aktivite ve Sanal Gerçeklik Eğitiminin Fiziksel İşlev, Biliş ve Yaşam Kalitesi Üzerine Etkilerinin Karşılaştırılması
Sayın Katılımcı,

Yukarıda adı yazılı araştırmaya katılmak üzere davet edilmiş bulunmaktasınız. Bu araştırmada yer almayı kabul etmeden önce, araştırmanın ne amaçla yapılmak istendiğini anlamanız ve bu bilgilendirme sonucunda kararınızı vermeniz gerekmektedir. Aşağıdaki bilgileri lütfen dikkatlice okuyunuz, sorularınız olursa sorunuz ve açık yanıtlar isteyiniz.

Bu araştırma ile Şizofreni hastalarında fiziksel fonksiyon, biliş ve yaşam kalitesi üzerinde fiziksel aktivite ve Sanal Gerçeklik eğitiminin etkilerini karşılaştırmayı amaçlamaktadır. Amaçlanmıştır.

Bu araştırma, şizofreni hastaları için fayda sağlayacaktır. Araştırmaya dahil edilen tüm bireyler, Sağlık Bakanlığı Kartal Dr Lütfi Kırdar Şehir Hastanesi'nde görev alan psikiyatri hekimi tarafından DSM-V tanı ölçütlerine göre şizofreni tanısı konan bireylerden alınacaktır. Araştırmaya sizin dışınızda 38 kişi katılacaktır. Sizden bu çalışmada Fiziksel aktivite grubu, ısınma, güçlendirme, denge ve aerobik egzersizleri içeren 45 dakikalık egzersizler yapacaktır. Sanal gerçeklik grubu ise NintendoWii-Fit™ oyunlarında ısınma, güçlendirme, denge ve aerobik egzersizleri içeren 45 dakikalık bir antrenman yapacaktır. Çalışmada, Sanal gerçeklik grubu için Nintendo Wii-Fit konsolu ve televizyon ekranı ile oyunları oynamanız istenilecektir. Bu işlem 45 dakikanızı alacaktır. Bunun size ve yakınlarınıza hiçbir zararı olmayacaktır. Çalışmaya katılmakla parasal yük altına girmeyeceksiniz ve size de herhangi bir ödeme yapılmayacaktır.

Bu araştırmaya katılıp katılmamakta tümüyle özgürsünüz. Gerek duyduğunuz tüm bilgileri istemeye ve doğru, açık, anlaşılır bilgi almaya hakkınız vardır. Araştırmaya katılmayı istemezseniz burada size verilen hizmet olumlu veya olumsuz şekilde etkilenmeyecektir. Gerekli gördüğü takdirde araştırmanın herhangi bir kısmında katılımcı araştırmadan çıkabilir, araştırmacı çalışmayı sonlandırabilir. Araştırmanın tüm aşamalarında kimlik bilgileriniz gizli tutulacaktır. Araştırma kapsamında elde edilen bilgiler bilimsel amaçlarla kullanılabilir gizlilik kurallarına uyulmak kaydıyla sunulabilir ve yayınlanabilir.

Araştırma ile ilgili daha fazla bilgiye ihtiyaç duyarsanız araştırmacıya Fzt. Salsabeel ABDULHADY e-posta adresi Salsabeel.abdulhady2020@gmail.com veya +90 530 479 03 22 numaralı telefondan ulaşabilirsiniz.

Yukarıda yer alan ve araştırmaya başlanmadan önce katılımcılara verilmesi gereken bilgileri içeren metni okudum (ya da sözlü olarak dinledim). Araştırma kapsamında elde edilen şahsıma ait bilgilerin bilimsel amaçlarla kullanılmasını, gizlilik kurallarına uyulmak kaydıyla sunulmasını ve yayınlanmasını, hiçbir baskı ve zorlama altında kalmaksızın, kendi özgür irademle kabul ettiğimi beyan ederim

İmza/Tarih	İmza/Tarih
Katılımcının adı soyadı	Sorumlu Araştırmacının adı soyadı

APPENDIX C: SOCIODEMOGRAPHIC INFORMATION

Adı-soyadı: **Tel. No:**

Doğum Tarihi: …./……/…… Doğum Yeri:…….

Cinsiyeti: K (…). E (…) Yaşı:…….

Medeni Hali: 1.Bekar 2.Evli 3.Boşanmış 4.Ayrı

Varsa çocuk sayısı:

1. Kimlerle yaşadığı: 1) Yalnız ( ) 2) Aile ile ( ) 3) Bakım Merkezinde ( ) 4) Diğer ( )
2. İkameti: 1) Kent ( ) 2) Kırsal ( )
3. Eğitim düzeyi: 1. Eğitim almamış ( ) 2. Toplam eğitim süresi/yıl: ( )
4. Mesleği:……..
5. Çalışma durumu: ( ) Çalışıyor ( ) Hiç Çalışmamış ( ) Hastalık vb nedenlerle çalışamıyor
6. İşlevsellik kaybı: 1: Var ( ) 2: Yok ( )
7. Sosyoekonomik Düzey: ( ) Alt ( ) Orta ( ) Üst
8. Kardeş sayısı: 1 2 3 4 5 6 6'dan fazla kardeş var
9. Sosyal güvence: 1.Var 2.Yok
10. Sosyal destekler: 1.Var 2.Yok 3.Yetersiz
11. Aile yapısı Çekirdek ( ) Geniş ( ) Parçalanmış ( )
12. Fiziksel hastalık öyküsü: a) Var b) Yok

    a) diyabet b) hipertansiyon c) kkh d) diğer (……..……)
13. Sigara-Alkol-Madde kullanımı: a) Var b) Yok

    1: Alkol ( ) Süresi ( )
    2: Psikoaktif Madde ( ) Süresi: ( )
    3: Sigara ( ) Süresi ( )
14. Adli Öykü: 1: Var ( ) 2: Yok ( )

    Varsa: Ceza alıp almadığı: ( ) Cezaevi deneyimi/ Süresi ( )
15. Ailede ruhsal hastalık öyküsü: a) Var b) Yok

    Varsa yakınlık derecesi: a) birinci derece b) ikinci derece
    – hastanın tanısı

    a) şizofreni-psikotik bozukluk b) duygudurum bozukluğu

    c) anksiyete bozukluğu d) mental retardasyon

16. Psikiyatrik Eş tanı: 1:Var ( ) 2:Yok ( )

    Varsa Tanısı: (……..)

17. Hastane yatışı var mı? 1: Var ( ) 2: Yok ( )
18. Varsa istemsiz yatış olmuş mu? 1: Evet ( ) 2. Hayır ( )

Varsa sayısı:

Ortalama yatış süresi:

Hastanede yatarak geçirilen toplam süre: ……/gün

19. İntihar girişimi var mı?

Varsa sayısı: Kullanılan yöntem:

20. Fiziksel şiddet içeren davranış sergileyip sergilemediği: 1: Evet ( ) 2: Hayır ( )

Hastalığın klinik özellikleri

Semptomların başlangıç yaşı (Yıl):

Hastalık semptomları başladıktan ne kadar süre sonra doktora başvurduğu: (Yıl)

Nihai tanı alana kadar farklı tanılar alıp almadığı: 1: Almış ( ) 2: Almamış ( )

Nihai Tanı ile ilk tedavi alma yaşı: (Yıl)

Toplam tedavisiz geçen süre (Yıl):

Tedavi uyumu var mı? 1: Evet ( ) 2: Hayır ( )

İlk Hastalık Dönemi:

Hastalığın ortaya çıkışında yaşam olayı: 1: Var ( ) 2: Yok ( )

Varsa: (…….)

Tanı:

Ilk Atak klinik gidişi:

1: Negatif Belirtiler (avolisyon,sosyal izolasyon, içe kapanma) ( )

2: Pozitif Belirtiler: (Sanrı, Varsanı, dezorganize davranış vb.) ( )

İlk Atak şiddeti: 1: Hafif ( ) 2: Orta ( ) 3: Ağır ( )

İlk Atak sonrası düzelme var mı? 1: Var ( ) 2: Yok ( ) 3: Kısmi Düzelme ( )

Varsa neyle? 1: Kendiliğinden

2: Ayaktan Medikal tedavi

3: Yatarak Medikal tedavi

4: EKT

5: Diğer: (…….)

Herhangi bir fiziksel şiddete maruziyet veya saldırı varsa olay detayını açıklayınız, skarları (defansif yara, psikopatik yara, silahlı yaralanma, cam kesisi, cerrahi insizyon vb.) not ediniz.

APPENDIX D: SIMPAQ (TURKISH)

KLİNİK İZLEM FORMU

Ad-Soyad:	Tarih:

BASİT FİZİKSEL AKTİVİTE ANKETİ (BFAA)

Açıklama: Size, **son yedi gün** içerisinde yatakta geçirdiğiniz, oturduğunuz veya uzandığınız, yürüdüğünüz, egzersiz yaptığınız, spor ve diğer aktivitelerle ilgili sorular soracağım.

1A. Son yedi gün içerisinde çoğunlukla saat kaçta yattınız?
Saat …..:….. ile …..:….. arasında diye yönlendiriniz.

Yanıt: …..:…….

1B. Son yedi gün içerisinde çoğunlukla saat kaçta kalktınız?

Yanıt: ……:…….

1. Gece başına yatakta geçirilen ortalama süre (saat) ☐

2A. Öyleyse diğer aktiviteler için günde yaklaşık ……. saatlik süre kalıyor. O …….. saatin ne kadarını yemek yeme, okuma, televizyon izleme, elektronik cihaz kullanmadaki gibi oturarak ya da uzanarak geçirdiniz?
Örneğin iş yerinde, toplu taşımada, boş zamanlarda veya evde diye yönlendiriniz.

Yanıt: Günde…..….saat……dakika

2B. Bu sürenin ne kadarını kestirerek (kısa uyuyarak) geçirdiniz?

Yanıt: Günde…..….saat……dakika

2A. Gün başına sedanter geçirilen ortalama süre (saat) ☐

3. Öyleyse diğer aktiviteler için günde yaklaşık …….saatlik süre kalıyor. Son yedi gün içerisinde hangi günlerde egzersiz ya da eğlence amaçlı veya bir yerden başka bir yere gitmek ya da gelmek için yürüdünüz? O günlerde yürümeye çoğunlukla kaç dakika harcadınız?

Pazartesi	Salı	Çarşamba	Perşembe	Cuma	Cumartesi	Pazar

3. Gün başına yürüyerek geçirilen ortalama süre (saat) ☐

4A. Şimdi jogging, koşma, yüzme, bisiklet sürme, spor salonu hareketleri, yoga, futbol ya da basketbol gibi egzersiz ve spor amacıyla yaptığınız herhangi bir aktiviteyi düşünün. Geçen hafta hangi günlerde bu ya da benzer aktivitelerden birini yaptınız?
4B. Hangi aktiviteleri yaptınız ve yaptığınız günlerde her aktiviteye ne kadar zaman ayırdınız?

	Aktivite ve Şiddet (0-10)	**Seans Sayısı**	**Dakika**	**Toplam**
örnek	Dirençli egzersiz (5/10); tenis (9/10)	1; 1	15; 50	65
Pazartesi				
Salı				
Çarşamba				
Perşembe				
Cuma				
Cumartesi				
Pazar				
		Toplam		

4. Gün başına spor / egzersiz ile geçirilen ortalama süre (saat) ☐

5. Şimdi işinizin bir parçası olarak yaptığınız fiziksel aktiviteleri veya evdeyken yaptığınız bahçe ya da ev işleri gibi aktiviteleri düşünün.
Bu aktiviteleri yaparken çoğunlukla günde kaç dakika harcadınız?
Bunlara yürüyüş, spor veya egzersiz dahil değildir diye yönlendiriniz.

Yanıt: Günde…..……dakika

5. Gün başına diğer aktivitelerle geçirilen ortalama süre (saat) ☐

Kontrol edin: 1, 2A, 3, 4 ve 5 numaralı kutucukların toplamı yaklaşık 24 saat olmalıdır.

APPENDIX E: THE CALGARY DEPRESSION SCALE FOR SCHIZOPHRENIA (CDSS) (TURKISH)

Calgary Şizofrenide Depresyon Ölçeği Uygulayan: Tarih:

1. Depresyon: Son iki hafta boyunca ruh halinizi nasıl tanımlarsınız? Yeterince neşelenebiliyor muydunuz, yoksa son zamanlarda aşırı çökkün ya da üzüntülü müydünüz? Son iki hafta içinde, her gün ne kadar sıklıkta kendinizi [KENDİ KELİMELERİ] hissediyorsunuz? Gün boyu?

- ☐ 0. Yok
- ☐ 1. Hafif: Sorulduğunda biraz üzüntü ya da güvensizlik ifade eder
- ☐ 2. Orta: Son iki hafta boyunca zamanın neredeyse yarısından fazlasında süren belirgin çökkün duygudurum: her gün var
- ☐ 3. Şiddetli: Her gün zamanının yarısından fazlasında süren, olağan motor ve toplumsal işlevselliği etkileyen belirgin çökkün duygudurum

2. Umutsuzluk: Geleceğinizi nasıl görüyorsunuz? Sizin için herhangi bir gelecek var mı? Yoksa yaşam oldukça umutsuz mu görünüyor? Kendinizi koyuverdiniz mi yoksa hala çaba göstermek için neden var mı?

- ☐ 0. Yok
- ☐ 1. Hafif: Son iki hafta boyunca bazen umutsuzluğa kapılmış ama hala gelecek için belli düzeyde umut taşıyor
- ☐ 2. Orta: Son iki hafta boyunca ısrarlı, orta düzeyde umutsuzluk duygusu. İşlerin daha iyiye gidebileceği konusunda ikna edilebiliyor
- ☐ 3. Şiddetli: Israrlı ve sıkıntı veren umutsuzluk duygusu

3. Değersizlik Duygusu: Başka insanlarla karşılaştırdığınızda, kendinizi nasıl görüyorsunuz? Kendinizi başka insanlardan daha mı iyi, daha mı kötü, yoksa yaklaşık aynı düzeyde mi görüyorsunuz? Kendinizi başkalarından aşağıda ya da hatta değersiz mi hissediyorsunuz?

- ☐ 0. Yok
- ☐ 1. Hafif: Kısmen aşağılık duygusu var; değersizlik duygusu düzeyine ulaşmıyor.
- ☐ 2. Orta: Kişi kendini değersiz hissediyor; ama zamanının yarısının azında
- ☐ 3. Şiddetli: Kişi zamanın yarısından fazlasında kendisini değersiz hissediyor. Öyle olmadığı konusunda ikna edilebiliyor

4. Suçlulukla İlgili Alınma Düşünceleri: Bir konuda itham edildiğiniz ya da hatta haksız yere suçlandığınız duygusuna kapıldınız mı? Hangi konuda? (Doğrulanabilir itham ya da suçlamaları dahil etmeyin. Suçluluk sanrılarını dışlayın)

- ☐ 0. Yok
- ☐ 1. Hafif: Kişi zamanın yarısından azında kendini itham altında hisseder ama suçlu hissetmez
- ☐ 2. Orta: İtham altında olduğuna dair ısrarlı duygular ve/veya ara sıra suçlu olduğuna dair duygular
- ☐ 3. Şiddetli: Suçlu olduğuna dair ısrarlı duygular. İkna edilmeye çalışılınca, öyle olmadığını kabul eder

5. Patolojik Suçluluk: Geçmişte yapmış olabileceğiniz önemsiz şeylerden dolayı kendinizi kabahatli bulma eğiliminde misiniz? Bu konuyla bu derecede uğraşmayı hakkettiğinizi düşünüyor musunuz?

- ☐ 0. Yok
- ☐ 1. Hafif: Kişi bazen bazı küçük kabahatler konusunda olması gerekenden daha fazla suçluluk duyar, ama bu, zamanın yarısından azını alır
- ☐ 2. Orta: Kişi çoğu zaman (zamanın yarısından fazlasında) önemini abarttığı geçmiş eylemleri konusunda suçluluk duyar
- ☐ 3. Şiddetli: Kişi çoğu zaman kötü giden her şey için, hatta kendi hatası olmasa bile kendini kabahatli hisseder

6. Sabah Depresyonu: Son iki hafta boyunca, kendinizi çökkün hissederken, bu çökkünlüğün günün belli bir zamanında daha kötüleştiğini fark ettiniz mi?

- ☐ 0. Yok: Depresyon yok
- ☐ 1. Hafif: Depresyon var ama gün içi değişkenlik yok
- ☐ 2. Orta: Depresyonun sabahları kötüleştiği kendiliğinden belirtilir
- ☐ 3. Şiddetli: Sabahları belirgin biçimde daha kötü olan ve işlevselliğin bozulduğu depresyon akşamları düzelir

7. Erken Uyanma: Sabahları normalden daha erken mi uyanıyorsunuz? Bu, haftada kaç kez oluyor?

- ☐ 0. Yok: Erken uyanma yok
- ☐ 1. Hafif: Ara sıra (en çok haftada iki kez) olağan ya da gerekli uyanma zamanından en az 1 saat önce uyanıyor
- ☐ 2. Orta: Çoğunlukla (haftada en fazla 5 kez) olağan ya da gerekli uyanma zamanından en az 1 saat önce uyanıyor
- ☐ 3. Şiddetli: Her gün uyanma zamanından en az 1 saat önce uyanıyor

8. Özkıyım: Hayatın yaşamaya değer olmadığını hissediyor musunuz? Yaşamınıza son vermek hiç içinizden geçti mi? Kendinize ne yapabileceğinizi düşündünüz? Gerçekten denediniz mi?

- ☐ 0. Yok
- ☐ 1. Hafif: Sıklıkla keşke ölmüş olsaydım biçiminde düşünceler ya da ara sıra özkıyım düşünceleri
- ☐ 2. Orta: Üzerinde uğraşılmış özkıyım tasarısı ama girişimde bulunulmamıştır
- ☐ 3. Şiddetli: Açıkça ölümle sonuçlanmak üzere hazırlanmış özkıyım girişimi (örn.: şans eseri fark edilme ya da etkisiz yöntem)

9. Gözlenen Depresyon: Tüm görüşme boyunca görüşmecinin gözlemlerine dayanır. Görüşmede uygun anlarda sorulan "Kendinizi ağlamaklı hissediyor musunuz?" sorusu bu gözle için gerekli bilgiyi sağlayabilir.

- ☐ 0. Yok
- ☐ 1. Hafif: Görüşmenin belirgin olarak yansız konuşmalarını içeren bölümlerinde bile kişi üzgün ya da kederli görünmektedir.
- ☐ 2. Orta: Kişi görüşme boyunca sıkkın, tek düze bir ses tonuyla üzgün ve kederli görünmektedir ve bazen ağlar ya da ağlamaklı olur.
- ☐ 3. Şiddetli: Kişi sıkıntı veren konularda boğulacak gibi olur, sıklıkla derin iç çeker ve açıkça ağlar, ya da kişi ısrarlı olarak ıstıraptan donakalmış durumdadır ancak görüşmeci depresyonun varolduğundan emindir.

Skor: ☐

APPENDIX F: MINI-MENTAL STATE EXAMINATION (MMSE) (TURKISH)

Mini Mental Durum Testi
Mini-Mental State Examination (MMSE)

Hastanın Adı Soyadı: _____ Tarih: ____/____/_____

Oryantasyon (Her doğru cevap 1 puan, toplam 10 puan)			
	Puan	Puan	
Hangi yıl içindeyiz?	_____	_____	Hangi ülkede yaşıyoruz?
Hangi mevsimdeyiz?	_____	_____	Şu an hangi şehirde bulunmaktasınız?
Hangi aydayız?	_____	_____	Şu an bulunduğunuz semt neresidir?
Bugün ayın kaçı?	_____	_____	Şu an bulunduğunuz bina neresidir?
Hangi gündeyiz?	_____	_____	Şu an bu binada kaçıncı kattasınız?
			Oryantasyon Bölüm Toplamı (0-10): _____

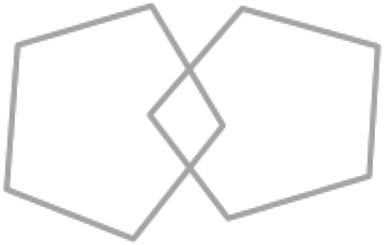
Kayıt Hafızası (Toplam puan 3)	Puan
• Size birazdan söyleyeceğim üç ismi dikkatlice dinleyip ben bitirdikten sonra tekrarlayın (**Masa**, **Bayrak**, **Elbise**) (20 sn. süre tanınır). Her doğru isim 1 puan.	_____

Dikkat ve Hesap Yapma (Toplam puan 5)	Puan
• 100'den geriye doğru 7 çıkartarak gidin. Dur deyinceye kadar devam edin. (Her doğru işlem 1 puan: 100, 93, 86, 79, 72, 65)	_____

Hatırlama (Toplam puan 3)	Puan
• Yukarıda tekrar ettiğiniz kelimeleri tekrar söyleyin (**Masa, Bayrak, Elbise**) (Her kelime 1 puan)	_____

Lisan (Toplam puan 9)	Puan
a. Bu gördüğünüz nesnelerin isimleri nedir? (**saat**, **kalem**) 1'er puan, toplam 2 puan (20 saniye süre ver)	_____
b. Şimdi size söyleyeceğim cümleyi dikkatle dinleyin ve ben bitirdikten sonra tekrar edin. "**Eğer ve fakat istemiyorum**" (10 saniye süre ver) 1 puan	_____
c. Şimdi sizden bir şey yapmanızı isteyeceğim, beni dikkatle dinleyin ve söylediğimi yapın. "Masada duran kâğıdı 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) -Bir kâğıda "GÖZLERİNİZİ KAPATIN" yazıp hastaya gösterin-	_____
e. Şimdi vereceğim kâğıda aklınıza gelen anlamlı bir cümleyi yazın (1 puan)	_____
f. Size göstereceğim şeklin aynısını çizin; aşağıdaki şekli arka sayfaya (1 puan)	_____

Folstein MF, Folstein SE, McHugh PR (1975) J Psychiatr Res. 1975 Nov;12(3):189-98.



Toplam Puan (0-30): _____

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Tasarım ve düzenleme: Dr. Ender Saltaş 2022

APPENDIX G: THE SHORT FORM 36 (SF-36)

SF-36 (Kısa Form 36)

Hastanın Adı Soyadı: _____ Tarih: ____/____/____

Aşağıdaki sorular sizin kendi sağlığınız hakkındaki görüşünüzü, kendinizi nasıl hissettiğinizi ve günlük aktivitelerinizi ne kadar yerine getirebildiğinizi öğrenmek amacındadır. Size en uygun yanıtı verin.

B1

1) Genel olarak sağlığınız için aşağıdakilerden hangisini söyleyebilirsiniz?

Mükemmel	Çok iyi	İyi	Orta	Kötü
❑1	❑2	❑3	❑4	❑5

B2

2) Bir yıl öncesi ile karşılaştırdığınızda şu anki genel sağlık durumunuzu nasıl değerlendirirsiniz?

	Çok daha iyi	Biraz iyi	Hemen hemen aynı	Biraz daha kötü	Çok daha kötü
Bir yıl öncesinden	❑1	❑2	❑3	❑4	❑5

B3

Aşağıdaki sorular bir gün içinde yapabileceğiniz işlerle (aktivitelerle) ilgilidir. Sağlığınız bu aktiviteleri kısıtlıyor mu? Eğer kısıtlıyorsa, ne kadar?

	Evet, Çok Kısıtlı	Evet, Biraz Kısıtlı	Hayır, Hiç Kısıtlı Değil
3) Koşmak, ağır kaldırmak, ağır sporlara katılmak gibi ağır etkinlikler	❑1	❑2	❑3
4) Bir masayı çekmek, elektrik süpürgesini itmek ve ağır olmayan sporları yapmak gibi orta dereceli etkinlikler	❑1	❑2	❑3
5) Market poşetlerini kaldırmak veya taşımak	❑1	❑2	❑3
6) Birkaç kat merdiven çıkmak	❑1	❑2	❑3
7) Bir kat merdiven çıkmak	❑1	❑2	❑3
8) Eğilmek, diz çökmek, çömelmek, diz çökmek	❑1	❑2	❑3
9) Bir kilometreden fazla yürümek	❑1	❑2	❑3
10) Birkaç yüz metre yürümek	❑1	❑2	❑3
11) Yüz metre yürümek	❑1	❑2	❑3
12) Kendi başına banyo yapmak ve giyinmek	❑1	❑2	❑3

B4

Son 4 hafta boyunca bedensel sağlığınızın sonucu olarak, işiniz veya diğer günlük etkinliklerinizde, aşağıdaki sorunlardan biriyle karşılaştınız mı?

	Evet	Hayır
13) Çalışma yaşamınızda veya diğer aktivitelerinizde geçirdiğiniz zamanı kısalttınız mı?	❑1	❑2
14) Arzu ettiğinizden daha az şeyi mi tamamlayabildiniz?	❑1	❑2
15) Çalışma veya diğer yaptığınız işlerin çeşidinde kısıtlama yaptınız mı?	❑1	❑2
16) Çalışma yaşamınızda veya diğer aktivitelerinizi yapmakta güçlük çektiniz mi? (Aşırı efor - çaba sarf ettiniz mi?)	❑1	❑2

B5

Son 4 hafta boyunca, duygusal sorunlarınızın (örneğin çökkünlük veya kaygı) sonucu olarak işiniz veya diğer günlük etkinliklerinizle ilgili aşağıdaki sorunlarla karşılaştınız mı?

	Evet	Hayır
17) Çalışma yaşamınızda veya diğer aktivitelerinizde geçirdiğiniz zamanı kısalttınız mı?	❑1	❑2
18) Arzu ettiğinizden daha az işi mi tamamlayabildiniz?	❑1	❑2
19)İşinizle veya diğer aktivitelerinizle ilgili işleri her zamanki kadar dikkat vererek yapamadınız mı?	❑1	❑2

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SF-36 (Kısa Form 36) Sayfa-2

B6 20) Son 4 hafta boyunca bedensel sağlığınız veya duygusal sorunlarınız, aileniz, arkadaş veya komşularınızla olan olağan sosyal etkinliklerinizi ne kadar etkiledi?

Hiç Etkilemedi	Çok Az	Orta Derecede	Epeyce	Çok Fazla
❑1	❑2	❑3	❑4	❑5

B7 21) Son 4 hafta içinde vücudunuzda ne kadar ağrı oldu?

Hiç Olmadı	Çok Az	Hafif	Orta	Çok	Pek Çok
❑1	❑2	❑3	❑4	❑5	❑6

B8 22) Son 4 hafta boyunca ağrınız, normal işinizi (hem ev işlerinizi hem ev dışı işinizi düşününüz) ne kadar etkiledi?

Hiç Etkilemedi	Biraz etkiledi	Orta Derecede	Epey Etkiledi	Çok Etkiledi
❑1	❑2	❑3	❑4	❑5

B9 Aşağıdaki sorular sizin son 4 hafta boyunca neler hissettiğinizle ilgilidir. Her soru için, sizin duygularınızı en iyi karşılayan yanıtı, son 4 haftadaki sıklığını göz önüne alarak seçiniz.

	Sürekli	Çoğu zaman	Epey zaman	Bazen	Ara sıra	Hiç bir zaman
23) Kendinizi yaşam dolu olarak hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
24) Çok sinirli biri oldunuz mu?	❑1	❑2	❑3	❑4	❑5	❑6
25) Hiçbir şeyin sizi neşelendiremeyeceği kadar moraliniz bozuk ve kötü oldu mu?	❑1	❑2	❑3	❑4	❑5	❑6
26) Kendinizi sakin ve huzurlu hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
27) Çok enerjik oldunuz mu?	❑1	❑2	❑3	❑4	❑5	❑6
28) Kendinizi kalbi kırık ve üzgün hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
29) Kendinizi yıpranmış, bitkin hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6
30) Mutlu, sevinçli bir insan oldunuz mu?	❑1	❑2	❑3	❑4	❑5	❑6
31) Yorgunluk hissettiniz mi?	❑1	❑2	❑3	❑4	❑5	❑6

B10 32) Son 4 hafta boyunca bedensel sağlığınız veya duygusal sorunlarınız sosyal etkinliklerinizi (arkadaş veya akrabalarınızı ziyaret etmek gibi) ne sıklıkta etkiledi?

Sürekli	Çoğu zaman	Bazen	Ara sıra	Hiç bir zaman
❑1	❑2	❑3	❑4	❑5

B11 Aşağıdaki her bir ifade sizin için ne kadar doğru veya yanlıştır? Her bir ifade için en uygun olanını işaretleyiniz.

	Kesinlikle doğru	Çoğunlukla doğru	Emin değilim	Çoğunlukla yanlış	Kesinlikle yanlış
33) Ben diğer insanlara göre daha kolay hastalanıyorum	❑1	❑2	❑3	❑4	❑5
34) Tanıdığım kişiler kadar sağlıklıyım.	❑1	❑2	❑3	❑4	❑5
35) Sağlığımın kötüleşmekte olduğunu sanıyorum.	❑1	❑2	❑3	❑4	❑5
36) Sağlığım mükemmeldir.	❑1	❑2	❑3	❑4	❑5

Ware JE Jrl, Sherbourne CD (1992) Med Care. 1992 Jun;30(6):473-83

APPENDIX H: THE LAWTON BRODY INSTRUMENTAL ACTIVITIES OF DAILY LIVING SCALE (IADL)

Lawton & Brody Enstrümantal Günlük Yaşam Aktiviteleri Ölçeği

Instrumental Activities of Daily Living (IADL)

Hastanın Adı Soyadı: _____ Tarih: ____/____/_____

Hastaya en çok uyan yanıtı işaretleyin. Formu hastanın kendisinden, yakınlarından ya da hastaya ait yakın tarihli kayıtlardan yararlanarak doldurabilirsiniz.

A		Telefonu kullanabilme;
	❑1	Telefonu rahatlıkla kullanabilir
	❑1	Birkaç iyi bilinen numarayı çevirebilir
	❑1	Telefona cevap verir, ancak arayamaz
	❑0	Telefonu hiç kullanamaz
B		Alışveriş;
	❑1	Tüm alışverişini bağımsız olarak kendisi yapar
	❑0	Küçük alışverişlerini kendisi yapar
	❑0	Tüm alışverişlerinde yardıma ihtiyaç duyar
	❑0	Alışveriş yapamaz
C		Yemek hazırlama;
	❑1	Yeteri kadar yemeği planlar, hazırlar ve servis edebilir
	❑0	Kullanılacak malzeme sağlanırsa yeteri kadar yemek hazırlayabilir
	❑0	Hazır yemeği ısıtır ve sunar veya yemek hazırlar ancak yeterli diyeti sağlayamaz
	❑0	Yemeklerin hazırlanması ve servis edilmesine ihtiyacı vardır
D		Ev temizliği;
	❑1	Yalnız başına veya nadir destekle evin üstesinden gelir
	❑1	Bulaşık yıkama, yatak yapma gibi günlük hafif işleri yapabilir
	❑1	Günlük hafif işleri yapar ancak yeterli temizliği sağlayamaz
	❑0	Tüm ev idame işlerinde yardıma ihtiyaç gösterir
E		Çamaşır;
	❑1	Kişisel çamaşırını tamamen kendisi yıkar
	❑1	Çorap, mendil gibi küçük malzemeleri yıkayabilir
	❑0	Tüm çamaşır işi başkaları tarafından halledilmek zorundadır
F		Yolculuk;
	❑1	Toplu taşım araçlarından bağımsız olarak faydalanır veya kendi arabasını kullanır
	❑1	Taksiye biner, toplu taşım araçlarını kullanamaz
	❑1	Başkalarının yardımı ile toplu taşım araçlarından faydalanabilir
	❑0	Yolculuğu başkalarının yardımı ile taksi veya otomobille sınırlıdır
	❑0	Yolculuk yapamaz
G		İlaçlarını kullanabilme sorumluluğu;
	❑1	İlaçlarını zamanında ve belirtilen dozda alabilir
	❑0	İlaçları önceden farklı dozlarda hazırlanırsa düzenli kullanabilir
	❑0	İlaçlarını kendi başına düzenli kullanamaz
H		Mali işler;
	❑1	Bağımsız olarak tüm mali işlerinin üstesinden gelebilir
	❑1	Günlük mali işlerini halleder ancak büyük mali işlerde ve banka işlerinde yardıma ihtiyaç gösterir.
	❑0	Mali işlerini takip edemez

Skorlama: Hasta her A-H arasındaki sorulardan; bir harf için 1 puan ile puanlandırılır. Skor aralığı 0-8'dir. Düşük skor daha fazla bağımlılık anlamına gelir.

Toplam Puan: _____

Lawton MP, Brody EM Gerontologist. 1969;9(3):179-186.

APPENDIX I: KATZ INDEX OF INDEPENDENCE IN ACTIVITIES OF DAILY LIVING (TURKISH)

Katz Günlük Yaşam Aktiviteleri Ölçeği

Katz Index of Independence in Activities of Daily Living (ADL)

Hastanın Adı Soyadı: _____ Tarih: ____/____/_____

Etkinlikler	Puan	Bağımsız (1 Puan)	Bağımlı (0 Puan)
Banyo yapma	_____	Kendi başına yıkanabiliyor veya vücudunun küçük bir parçasının yıkanması için yardım alıyor.	Kendi başına yıkanamıyor veya vücudunun büyük bir kısmının yıkanmasında başkasına ihtiyaç duyuyor
Giyinme	_____	Dolaptan kendi başına kıyafetlerini çıkarıp giyinebilir (Ayakkabısını bağlarken yardım alabilir).	Giyinirken yardım alıyor veya tamamen başkası tarafından giydiriliyor.
Tuvalet yapma	_____	Tuvalete gitme, tuvaletini yapma, temizlenme, üzerini tekrar giyme gibi aktiviteleri kendi başına yapabiliyor.	Tuvalete giderken yardım alıyor, tek başına temizlenme vb. etkinlikleri yapamıyor ya da lazımlık (sürgü) veya lazımlıklı iskemle kullanıyor.
Transfer	_____	Yataktan kanepeye veya tersi etkinliği tek başına veya baston vb. cihaz ile yapabiliyor.	Yataktan sandalyeye geçerken kısmi veya tam olarak bir başkasının yardımına ihtiyaç duyuyor.
Kontinans	_____	Defekasyon ve mesane üzerine tam kontrolü mevcut.	Kısmi veya tam mesane veya bağırsak inkontinansı mevcut
Beslenme	_____	Yemeği tabaktan ağzına kendisi götürebiliyor (Yemeği başkası hazırlayabilir).	Bir başkası tarafından yediriliyor veya parenteral beslenmeye muhtaç

Katz, S., Down, T.D., Cash, H.R., & Grotz, R.C. (1970) Progress in the development of the index of ADL. The Gerontologist, 10(1), 20-30.

Toplam Puan: _____ (6 puan: hasta bağımsız / 0 puan: hasta tam bağımlı)

APPENDIX J: CURRICULUM VITAE

Personal Informations

Name	SALSABEEL	**Surname**	ABDULHADY

Education

Degree	Department	The name of the Institution Graduated From	Graduation year
Doctorate	-	-	-
Master	PHYSIOTHERAPY AND REHABILITATION	**YEDITEPE UNIVERSITY**	2023
University	PHYSIOTHERAPY AND REHABILITATION	**BAHCESEHIR UNIVERSITY**	2020
High school	-	SANDS INTERNATIONAL SCHOOLS	2016

Languages	Grades (#))
ARABIC	MOTHER LANGUAGE
ENGLISH	8.00 IELTS
TURKISH	B2 TOMER

All the grades must be listed if there is more than one (KPDS, ÜDS, TOEFL; EELTS vs),

Work Experience (Sort from present to past)

Position	Institute	Duration (Year - Year)
PHYSIOTHERAPIST	WELLFIZYO	2021-PRESENT-
INTERN PHYSIOTHERAPIST	MEDICAL PARK	2020-2021-

Computer Skills

Program	Level
MICROSOFT WORD	EXCELLENT
MICROSOFT EXCEL	GOOD
PHOTOSHOP	AVERAGE

***Excellent , good, average or basic**

Others (Projects / Certificates / Rewards)

Deconstructing Non-specific Low Back Pain - Mark Laslett February 2023 Primephysio UK - Cairo, Egypt
The McKenzie Mechanical Diagnosis and Therapy (MDT) - Hans Van Helvoirt Part A and Part B - February 2023 The McKenzie Institute - New Zealand
Spinal and peripheral Manipulation Dipolma – January 2023 – Primephysio UK Istanbul Turkey
Management of Lower Limb Sports Injuries - Steve Sparks - June 2022 Primephysio UK- Cairo, Egypt
Clinical Dry Needling Certificate Program - May 2022 Primephysio UK, Riyadh, Saudi Arabia
Orthopedic Manual Therapy Certificate (OMTC) - March 2022 Orthopedic Manuel Therapy Academy, Cairo, Egypt

APPENDIX K: THESIS CONTROL LIST

T.C. MARMARA ÜNİVERSİTESİ SAĞLIK BİLİMLERİ FAKÜLTESİ GİRŞİMSEL OLMAYAN KLİNİK ARAŞTIRMALAR ETİK KURULU BAŞVURU FORMU KONTROL ÇİZELGESİ

Araştırmanın Başlığı: **Şizofreni Hastalarında Fiziksel Aktivite ve Sanal Gerçeklik Eğitiminin Fiziksel Fonksiyon, Biliş ve Yaşam Kalitesi Üzerine Etkilerinin Karşılaştırılması**

	Uygun	Düzeltme	Gerekli değil
Başlık açık ve anlaşılır mı? Gereksiz ifadeler var mı? Başlık çalışmanın tipi, değişkenleri ve örneklemi kapsıyor mu?	X		
Araştırma problemi/sorusu tam ve açık bir şekilde ifade edilmiş mi?	X		
Araştırma problemi/sorusu hakkında yeterli bilgi sunulmuş mu? (Konu hakkında bilinenler, bilinmeyenler)	X		
Araştırmada incelenen yapı ve kavramlar tanımlanmış mı? Ayrıntılı açıklamalar yapılmış mı?	X		
Araştırmanın amacı değişkenleri, hedef kitleyi ve çalışma alanını tanımlıyor mu?	X		
Araştırma soruları veya hipotezler verilmiş mi? Araştırma soruları veya hipotezler uygun şekilde ifade edilmiş mi?	X		
Araştırmanın türü açıkça belirtilmiş mi? Araştırmanın türü probleme ve amaca uygun mu?	X		
Deneysel bir çalışma ise tasarım türü ayrıntılı verilmiş mi?	X		
Deneysel bir çalışma ise işlem ayrıntılı açıklanmış mı?	X		
Araştırmanın değişkenleri belirtilmiş mi?	X		
Araştırmanın yapılacağa yer belirtilmiş mi?	X		
Araştırmanın başlangıç ve bitiş tarihi belirtilmiş mi?	X		
Araştırmanın bütçesi hazırlanmış mı?			X
Evren ve örneklem açıkça tanımlanmış mı?	X		
Örneklem büyüklüğü belirtilmiş mi? Örnek büyüklüğünü belirlemek için kullanılan yöntem açıklanmış mı?	X		
Örneklem seçim yöntemi/yöntemleri belirtilmiş mi?	X		
Araştırmaya alınma ve dışlanma ölçütleri açıklanmış mı?	X		
Araştırmanın yapılacağı kurumdan yazılı/sözel izin alınmış mı?	X		
Katılımcılara yönelik bilgilendirilmiş onam oluşturulmuş mu? Ek'e konulmuş mu?	X		
Ölçüm araçlarının (Ölçekler, envanterler vb.) kullanım izni alınmış mı? İzin belgeleri ek'e konulmuş mu?	X		
Değişkenlerin nasıl ölçüldüğü açıklanmış mı?	X		
Veri toplama yöntemleri ve araçları belirtilmiş mi? Ayrıntılı açıklanmış mı?			
Ölçüm araçlarının geçerlik ve güvenirliği açıklanmış mı?	X		
Veri toplama yöntemi ve aracı örneklemin özelliklerine uygun mu?	X		
Verilerin nasıl, hangi koşullarda ne zaman ve ne kadar sürede toplandığı açıklanmış mı?	X		

İstatistik analiz yöntemleri belirtilmiş mi? Seçilen istatistik yöntemler uygun mu? Önemlilik testleri için anlamlılık düzeyi açıklanmış mı?	X		
Kaynakçada yer alan kaynakların tümü metin içinde gösterilmiş mi? Kullanılan kaynaklar güncel ve yeterli mi? Kaynak gösterme kurallarına uyulmuş mu?	X		
Veri toplama formları ek'e konulmuş mu?	X		
Yürütücünün ve Araştırmacıların özgeçmişi ek'e konulmuş mu?	X		
Tüm araştırmacılar tarafından imzalanmış taahhütname ek'e konulmuş mu?	X		

PROJE ( ) BİTİRME PROJESİ ( ) YÜKSEK LİSANS TEZİ (**X**) DOKTORA TEZİ ( )

Araştırma Yürütücüsünün Adı Soyadı: **Dr. Öğr. Üyesi Ebru AKBUĞA KOÇ**

Tarih: İmza: