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Observing the Impact of Exercise on Dementia: Challenges and Benefits in Daily Functioning

Alishah Barkat
alishasanghani8@gmail.com
DPT, Department of Allied Health Sciences, Indus University, Karachi

Dr. Hamna Bukhari
hamnabukhari262@gmail.com
Assistant Professor/Research Associate, Department of Allied Health Sciences, Indus University, Karachi

Dr. Okasha Anjum
drokashaanjumpt@gmail.com
Head of Department/Assistant Professor, Department of Allied Health Sciences, Indus University, Karachi
Corresponding Author: *Alishah Barkat alishasanghani8@gmail.com

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ABSTRACT

Dementia impact more than 55 million people all over the world, posing a growing public health concern. Traditional treatment has focused on medication to slow cognitive decline, but exercise has emerged as a complementary therapy. Existing literature identifies aerobic, resistance, and balance training as beneficial for improving neuroplasticity and physical function. However, many programs face hurdles in consistency and personalization. The study focused to find the impact of structured exercise programs on the daily functioning of dementia patients, identify common challenges in implementation, and assess strategies that were used to optimize outcomes. An observational study was conducted using standardized functional assessment and therapist observation. The study assessed the changes in cognitive function, mobility, and independence. This study found that most older adults with dementia exhibited severe cognitive impairment and low physical activity levels. A prominant linking was noticed between physical activity and cognitive function, highlighting the benefits of exercise in dementia care. Despite limitations like small sample size and cross-sectional design, the research emphasizes the need for structured interventions. It provides a valuable foundation for future studies and public health strategies in low-resource settings like Pakistan.

Keywords: *Dementia, Exercise, Daily Functioning, Cognitive Health, Non-Pharmacological Intervention, Neurodegeneration*

INTRODUCTION

Dementia is defined by acquired losses of cognitive as well as emotional abilities that are severe enough to impair everyday work and quality of life. However, there is no specific etiology or pathologic process implied by the term itself. Dementia can result from more than 55 conditions, some of which are nonprogressive. It mainly affects people in their later years; at age 60, its frequency is under 1%, and it doubles every five years to approach 30 to 50% by age 85.[1]

However, dementia frequently corresponds to numerous neuropathologies, among them AD (Alzheimer's disease) with cerebrovascular dysfunction. To diagnose dementia, it is essential to conduct a moderately detailed mental status assessment by a clinician, aimed at identifying difficulties in memory, language, attention, visuospatial abilities (like spatial awareness), executive functioning, and emotional state.

Additionally, the diagnosis must be supported by a documented history of cognitive decline and reduced ability to perform everyday tasks, typically verified by input from a close relative or friend.[2]

Diagnosing dementia requires a thorough and precise medical history. It is also necessary to interview an impartial observer, such as a family member. One makes an effort to characterize the kind and severity of the cognitive complaint or complaints, as well as their duration, previous and present social and professional functioning levels, and any safety issues. It may be possible to estimate the onset of an illness by knowing when a patient stopped driving or balancing the cheque book. By searching for additional reasons that might be causing a patient's decline, such as a history of mood disorders, trauma, stroke, or comparable symptoms in the family, one can customize the history. Estimating severity is possible by evaluation of a patient's premorbid function. It might prove useful to enquire about a patient's employment and educational background. Further inspections, such the National Adult Reading Test, can also be utilized to assess a patient's premorbid intellectual capacity if they are around 80 years old.[3]

Approximately 90% of individuals with dementia experience behavioral and psychological symptoms, such as psychosis, aggression, agitation, and depression, alongside cognitive decline. Psychotic features of dementia, including hallucinations and delusional thinking, can significantly influence cognitive deterioration, caregiver burden, and the likelihood of institutionalization. The progression and duration of the illness often intensify these psychotic symptoms. Various types of dementia may exhibit a broad spectrum of such behavioral and cognitive disturbances.[4]

The clinician must examine the functional effect of the most likely underlying condition. The degree of cognitive impairment found during the examination and the severity of functional impairment revealed by the patient's history find if the patient has dementia. The patient's unique cognitive and behavioral changes, their progression over time, and any symptoms pointing to underlying medical, neurological, or psychiatric conditions should all be highlighted in the history. Drugs, both prescription and over-the-counter, should be thoroughly examined as possible contributors to cognitive impairment. Common medications that can affect cognitive function include sedative-hypnotics, analgesics, anticholinergic, antihypertensive, and psychotropic.[5]

Engaging in physical activity plays a vital role in maintaining overall health. It is widely acknowledged as a key contributor to energy expenditure, significantly affecting energy balance and body composition. Moreover, physical activity is considered a crucial and modifiable factor that independently lowers the risk of various health conditions, including cardiovascular disease, stroke, type 2 diabetes, and certain cancers such as those of the colon and breast. It also contributes positively to mental well-being and helps reduce the risk of injuries and falls..[6]

Physical inactivity is a preventable risk variable for cardiovascular disease as well as an increasing number of other chronic diseases, like diabetes mellitus, obesity, hypertension, carcinoma of the breast and colon, depression, and disorders of the bones and joints, such as osteoporosis and osteoarthritis.[7] Effective treatments to encourage physical activity participation are developed with an awareness of the factors that influence people's physical activity levels. The statistical modelling employed to characterize the link between reported behavior and the determinants under study may be significantly impacted by even relatively small discrepancies in measures of physical activity participation.[8]

Although it is reasonable to assume that free-time physical activity makes up a very minor fraction of total operations, very less is known about the physical operations patterns of people who reside in establishing nations. Many people throughout the world may not even be familiar with the concept of "leisure-time physical activity." The various methods that various populations or demographic groups

accrue operations during the day must be considered in any international standard metrics of physical operations.[9]

The body of research on dementia prevalence is growing quickly, especially in low- and middle-income nations. Given the substantial ramifications for social, public, and planning policies, a reevaluation of prevalence and numbers worldwide is necessary.[10]

A public health concern in various parts of the world, including the UK, is still physical inactivity. Around two-thirds of men and three-quarters of women in the UK do not reach the government standards for physical activity, indicating low levels of activity. The growing prevalence of obesity coexists with this issue. Over the same time span, the prevalence of obesity in England rose from 13.2% in 1993 to 23.1% in 2005 for males and from 16.4% to 24.8% in women (The Information Centre, Lifestyle Statistics 2006). According to the IASO (2007), the UK is currently among the most obese countries in Europe.[11]

The age-standardized prevalence for people over 60 ranged in a narrow range, ranging from 5% to 7% in most parts of the world. Latin America had the peak incidence (8.5%), while the four sub-Saharan African areas had the lowest prevalence (2%–4%). In 2010, 35.6 million people worldwide were estimated to have dementia; this figure is predicted to approximately double per 20 years, approaching 65.7 million in 2030 and 115.4 million in 2050. In 2010, 58% of dementia patients resided in low- or middle-income nations; by 2030, this percentage is predicted to increase to 63%, and by 2050, it will reach 71%.[12]

By 2050, there will likely be 131 million dementia sufferers worldwide, up from the latest 47 million. Over the last 20 years, the United States (US) and other industrialized nations have observed reducing in the age-adjusted incidence of dementia, which may be associated to increasing levels of formal education. However, dementia's negative impact will only worsen in the shortage of better therapies or preventative measures.[13]
According to a different study, the number of dementia cases worldwide has increased annually since 2005, when it was estimated that 24.3 million people had the disease. Dementia is a major cause of morbidity worldwide, accounting for 11.3% of years lived with a handicap.[14]

According to the prevalence for Australia, approximate of the number of people with dementia range from less than 200,000 to over 450,000. We evaluated the estimations' sources in order to comprehend these discrepancies. A question on if a person had been informed by a physician or nurse that they had dementia, including Alzheimer's, was part of the 2021 Australian census, which gathered information on the entire population (including those in hospitals and residential aged care).[15]

According to a study on dementia prevalence in Europe, the majority of the included studies indicate that dementia prevalence rises with age and is more common in women than in men. In particular, the meta-analysis's pooled prevalence estimates for women aged 65–69, 70–74, 75–79, 80–84, 85–89, and ≥90 years were 1.1%, 2.2%, 5.6%, 13.3%, 26.4%, and 38.9%, respectively. The meta-analysis's pooled prevalence estimates for men aged 65–69, 70–74, 75–79, 80–84, 85–89, and ≥90 years were 0.9%, 2.1%, 4.6%, 9.0%, 13.9%, and 31.2%, respectively.[16]

Age is the strongest and most well-known risk factor for dementia, hence the number of dementia cases in India could rise alarmingly. In India, the age-standardized dementia prevalence is 8.0% (95% CI, 6.8 to 9.2) while the approximated dementia prevalence among people 60 and older is 7.4% (95% CI, 6.4 to 8.5).[17] Research on dementia in Pakistan has been very inadequate thus far. There is currently a lack of data on clinical characteristics and no population-based investigation has been conducted. Because of this, creating evidence-based national guidelines is a challenging process. In any event, a clinical guideline is

essential for the effective and appropriate management of patients who are receiving care for dementia or who present with the disease in primary, secondary, and tertiary care facilities throughout the nation. In order to achieve this, the authors reviewed pertinent data on the epidemiology, diagnosis, management, and follow-up care of dementia using currently available technologies. They also reviewed international guidelines that have been published globally, with a focus on poor nations.[18]

More than 150,000 people in Pakistan, the sixth most populous country in the world, are said to have dementia. Forecasts indicate that by 2050, there will be 27 million people over the age of 65, up from the current 8 million, which will increase the prevalence of dementia.[19] Exercise therapies do, in fact, improve a number of cardiovascular risk factors, metabolism, body composition, and functional capacity, among other health outcomes in IwD. These elements are determinant risk element for the growth and progression of dementia. On the other hand, not much is known about how exercise affects the prevalence of BPSD or how stressful those symptoms might be for people who care for them. In order to enhance the quality of long-term care and reduce the formal career burden, it is critical for IwD in nursing homes to develop safe and effective exercise treatments that are focused on the management of BPSD and aim to slow the progression of decreases in functional ability and enhance their standard of life. To the best of the authors' knowledge, the caregiver's perspective of the results of exercise interventions is not emphasized, despite their intimate relationship with the IwD and their special observational role in institutional settings. Determining the potential beneficial impact of an exercise intervention on careers' perceptions of functional capacity, quality of life, and BPSD in institutionalized older individuals with mild to moderate dementia thus seems pertinent.[20]

METHODOLOGY

Study Design

This research employed a cross-sectional observational study design, conducted over a period of six months in Karachi. The primary objective was to observe and evaluate the impact of structured physical exercise on cognitive function and daily living tasks among people with dementia. The study was carried out in geriatric care units, outpatient rehabilitation facilities, and community centers that provide support to older adults. A cross-sectional design was chosen because it permitted the researchers to assess the prevalence of cognitive and functional changes associated with exercise at a specific point in time, offering valuable insights despite inherent limitations such as the inability to establish causality. The structured approach of the study ensured uniformity in data collection while also enabling the inclusion of diverse settings and participant backgrounds.

Sampling Technique

Participants were enlisted through non-probability convenience sampling, which was considered appropriate due to the specific nature of the target population and feasibility constraints. A total of 55 individuals diagnosed with mild to moderate dementia were enrolled based on defined eligibility criteria. Inclusion criteria consisted of being 50 years of age or more, having a clinical diagnosis of dementia, being medically stable and physically capable of engaging in structured exercise, and providing informed consent either personally or through a legal guardian. Individuals with comorbid psychiatric illnesses, significant physical disabilities preventing exercise, or terminal illnesses were excluded from the study. This sampling technique allowed for quick recruitment from available settings while acknowledging that it may restrict the generalizability of the findings.

Outcome Measure

The outcome measures included standardized and validated tools to assess both cognitive function and physical activity levels. The Mini-Mental State Examination (MMSE) was utilized to examine cognitive abilities, focusing on domains such as orientation, memory, attention, and language skills. The International Physical Activity Questionnaire (IPAQ) was administered to calculate the members' level of physical activity, including vigorous, moderate, and light activities performed over the past week. In addition to these primary measures, demographic and medical information was collected to provide context to the findings. These outcome measures were selected for their reliability, simplicity, and relevance to the study objectives.

Data Analysis Procedure

Data analysis was conducted using the Statistical Package for Social Sciences (SPSS), ensuring rigorous statistical treatment of the collected data. Descriptive statistics were utilized to summarize demographic information, cognitive scores, and activity levels. Inferential statistical tests, including chi-square tests and Pearson correlation analyses, were employed to examine associations between exercise participation and cognitive outcomes. Diagnostic analyses, such as assessments of reliability, normality, and homogeneity of variance, were also organized to make sure the robustness of the outcomes. This comprehensive analysis approach provided both an overview and detailed insight into the data, enabling meaningful interpretation of the relationships observed.

Ethical Consideration

This study obeyed to strict ethical standards throughout its implementation. Prior to data collection, ethical approval was secured from the Institutional Review Board of Indus University, ensuring that the study met all institutional and international guidelines for human subject research. Participation was entirely voluntary, and informed consent was obtained from all participants or their legal guardians before enrollment. Confidentiality and anonymity were strictly maintained, with data secured and reported in aggregate form to protect individual identities. These measures ensured that the rights, dignity, and safety of all participants were respected.

Reliability

The reliability of the tools used in this study was evaluated to confirm the internal consistency of the measurements. Cronbach's alpha was calculated for the MMSE and IPAQ instruments, demonstrating acceptable levels of reliability suitable for the target population. Reliability analyses indicated that the instruments consistently captured the constructs of cognitive functioning and physical activity without significant measurement error. This validation of the tools strengthened the credibility of the results and supported the use of these instruments in future research within similar contexts.

RESULT

INTRODUCTION

This chapter discusses the outcome of statistical applications on dependent variables, independent variables, and their combine relations. It reviews two aspects of data analysis i.e. (i) Data dissection and its visualization aiming to provide research glimpse briefly to general audience and (ii) Statistical descriptions including descriptive statistics, correlation & chi-square analysis, and diagnostic analysis.

This chapter of results & discussion contains nine sections; First section is introduction which discusses the target of chapter. The second section is data visualization of all data sets. Third Section is descriptive

statistical details of dependent variables with independent variables. The fourth section is correlation matrix of data which stated and discussed the inter-relation of variables. Fifth Section contains chi-square analysis which compares the actual and expected results leading to accept or reject null hypothesis. Sixth section is the discussion of diagnostic Analysis which attempted to ascertain that either all verification checks be maintained during that statistical tools' application or not. It includes Bility test, normality test, homogeneity test and multicollinearity test. Reliability test aims to identify the internal consistency of questionnaires, normality test aiming to find the symmetry or normality of responses. And homogeneity test aiming to vet that all chosen samples have had familiar characteristics. Moreover, multicollinearity aims to identify the condition in which two or more explanatory variables in a model are highly linearly related. The seventh section is summary which discusses the decision acceptance and rejection of hypothesis and overall chapter briefly along with results of this research.

DATA VISUALIZATION

Chart 1: Age-wise population

Showing break-up of population w.r.t. age brackets of respondents.

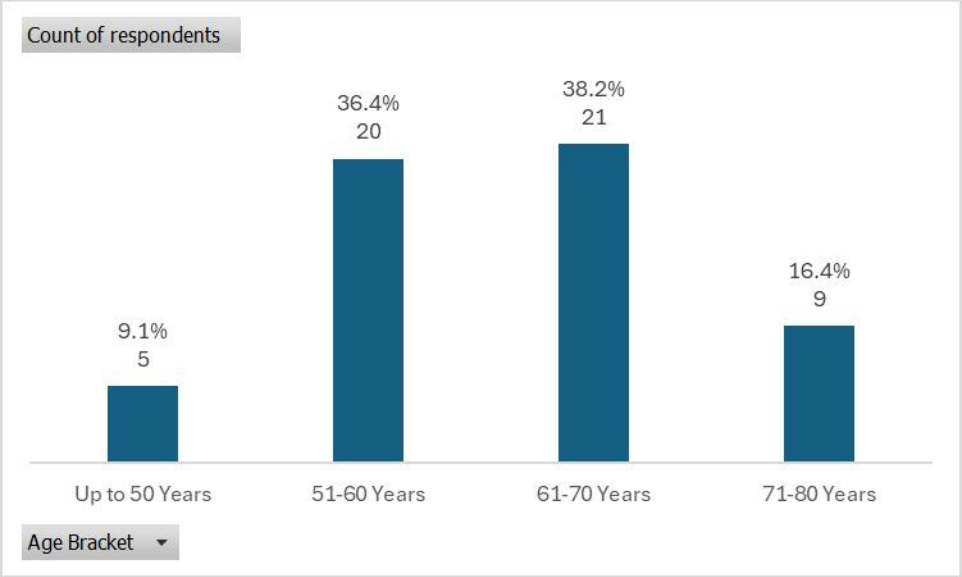

Chart-01 showing that fifty-five respondents have examine for research consist with four (04) age-brackets i.e., 05 respondents (9.1% of population) having age bracket of up to 50 years old, 20 respondents (36.4% of population) having age bracket of 51-60 years old, 21 respondents (38.2% of population) having age bracket of 61-70 years old and 09 respondents (16.4% of population) having age bracket of 41-50 years old.

Chart 2: Count of gender-wise Population:

Showing break-up of population of respondents w.r.t. count of gender-wise population.

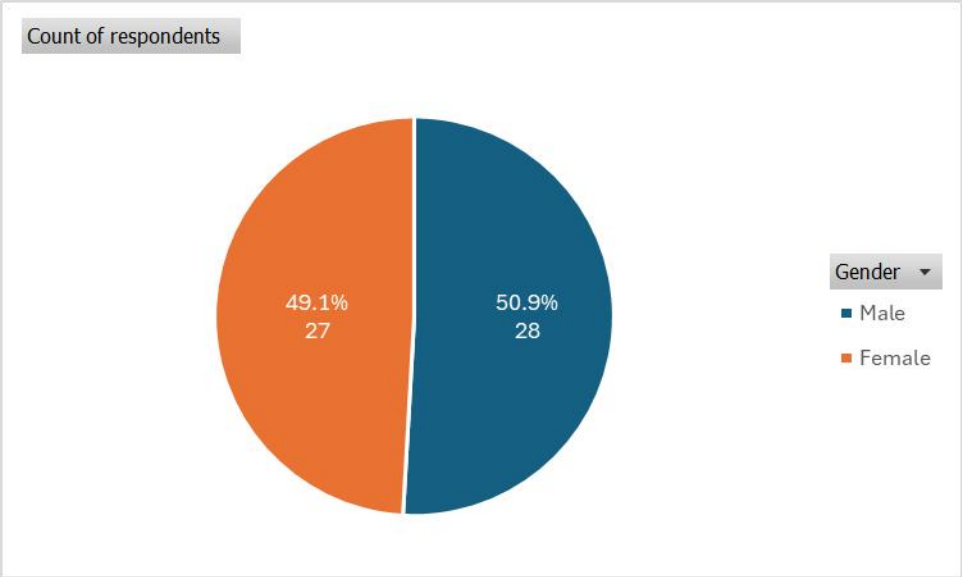

Chart-2 showing that Fifty-five respondents have examine for research consist with two (02) gender i.e., 28 respondents (50.9% of population) are males and 27 respondents (49.1% of population) are females.

DESCRIPTIVE STATISTICS

Table 1: Descriptive Analysis of variables Scale

DV Elements	N	Min.	Max.	Mean	SD	Variance	%
Age	55	50	80	65	.871	.759	65.5%

Above table shows descriptive analysis of variables related to Observing the impact of exercise in dementia: challenges and benefits in daily functioning showing that each element shows how frequently respondents made assertive answers against these questions; results showing that respondents have highest age is 80, lowest age is 50 within average of 65.

Table 2: Descriptive Analysis of MMSE Scale

MMSE	N	Min.	Max.	Mean	SD	Variance	%
Name 3 objects	55	0	3	2.22	1.15	1.322	73.9%
Serial 7's	55	0	5	2.73	1.75	3.091	54.5%
Ask for the 3 objects repeated above	55	0	3	0.87	1.17	1.372	29.1%
Name a pencil and watch	55	0	2	1.20	.951	.904	60.0%
Repeat the following "No ifs, ands, or buts"	55	0	1	0.58	.498	.248	58.2%
Follow a 3-stage command: "Take a paper in your hand, fold it in half, and put it on the floor."	55	0	3	1.55	1.25	1.586	51.5%
Read and obey the following: CLOSE YOUR EYES	55	0	1	0.42	.498	.248	41.8%

Write a sentence.	55	0	1	0.25	.440	.193	25.5%
Copy the design shown	55	0	1	0.18	.389	.152	18.2%

Above table showing descriptive analysis of MMSE related to Observing the impact of exercise in dementia: challenges and benefits in daily functioning'; study of each element showing how frequently respondents made assertive answers against these questions. MMSE is the parameters to show the overall involvement of respondents in response to Observe the impact of exercise in dementia: challenges and benefits in daily functioning study here and in the rest of documents as well; showing that 73.9% respondents have highest response for item "Name 03 objects" and 18.2% respondents have lowest response for item "Copy the design shown".

Table 3: Descriptive Analysis of IPAQ Scale

IPAQ	N	Min.	Max.	Mean	SD	Variance	%
During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling? (Days)	55	0	7	0	1	1	2.6%
How much time did you usually spend doing vigorous physical activities on one of those days? (Minutes)	55	0	180	5	29	836	3.0%
During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.(Days)	55	0	7	1	2	5	16.6%
How much time did you usually spend doing moderate physical activities on one of those days?(Minutes)	55	0	300	18	60	3548	6.0%
During the last 7 days, on how many days did you walk for at least 10 minutes at a time? (Days)	55	0	7	4	3	10	51.9%
How much time did you usually spend walking on one of those days? (Minutes)	55	0	120	12	19	361	10.3%
During the last 7 days, how much time did you spend sitting on a week days? (Minutes)	55	0	960	281	348	121450	29.3%

Above table showing descriptive analysis of IPAQ related to Observe the impact of exercise in dementia: challenges and benefits in daily functioning study of each element showing how frequently respondents made assertive answers against these questions. IPAQ is the parameters to show the overall involvement

of respondents in response to assess the Observe the impact of exercise in dementia: challenges and benefits in daily functioning study here and in the rest of documents as well; showing that 51.9% respondents have highest response for item "During the last 7 days, on how many days did you walk for at least 10 minutes at a time? (Days)" and 2.6% respondents have lowest response for item "During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling? (Days)".

Correlation Matrix

Correlation is a statistical method that ascertains whether and how strongly set of variables are connected. In this research, correlation coefficient computed from the sample data calculate the strength and direction (positive or negative) of a linear relationship between dependent and independent variables. If the value of the correlation coefficient is significant among the variable (s), we would have to go to evaluate the level of parity between the actual and expected results through Chi-square.

Table 4: Correlation Analysis of MMSE Prevalence

Annexed table-01 is the Correlation Analysis of MMSE assessment of depression shows the correlation between items of MMSE prevalence of our research data. Directions of relations among has positive and negative impact for association Relationship between Observe the impact of exercise in dementia: challenges and benefits in daily functioning' study. Results showing that "Read and obey the following: CLOSE YOUR EYES" has highest positive relationship to i.e. 19.0%, and the least relationship has found positive impact of item "Where are we (state) (country) (town) (hospital) (floor)?" i.e. -61.0% is correlated Negatively with mental state.

Table 5: Correlation Analysis of IPAQ Prevalence

Annexed table-02 is the Correlation Analysis of IPAQ assessment of physical activities shows the correlations between items of our research data. Directions of relations among has positive and negative impact for Observe the impact of exercise in dementia: challenges and benefits in daily functioning. Results showing that "During the last 7 days, how much time did you spend sitting on a week days? (Minutes)" has highest positive relationship to i.e. 92.0%, and the least relationship has found positive impact of item "How much time did you usually spend doing vigorous physical activities on one of those days? (Minutes)" i.e. 2.0% is correlated positively with physical activities prevalence.

Table 6: Correlation Analysis of Dependent variables

DVs Prevalence	Mental Status	Physical Activities status
Mental Status	1.00	0.10
Physical Activities status	0.10	1.00
**. Correlation is significant at the 0.01 level (2-tailed).		

Above table about correlation Analysis of which shows the correlations between all items of questionnaire of our research data. Directions of relation among all variables are correlated positive with all items for relationship, Observe the impact of exercise in dementia: challenges and benefits in daily functioning. Mental state has correlated with 10.00% correlation over physical activities, and vice versa.

CHI-SQUARE

It is a statistical measure which compares the actual and expected results leading to accept or reject null hypothesis. We reject the null hypothesis if the chi-square value is higher than the critical value. If you reject the null hypothesis, you can sum up that your data are prominently different from what you expected. Here we assume four (04) null hypotheses are as under to assess:

- **HO_1:** There is no prominent relationship between age groups and effect of exercise in dementia: challenges and benefits in daily functioning' study.
- **HA_1:** There is prominent relationship between age groups and effect of exercise in dementia: challenges and benefits in daily functioning' study.
- **HO_2:** There is no prominent relationship between gender and effect of exercise in dementia: challenges and benefits in daily functioning' study.
- **HA_2:** There is prominent relationship between gender and effect of exercise in dementia: challenges and benefits in daily functioning' study.
-

Table 7: Case Processing Summary

	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age Bracket * Mental Status	55	100%	0	0%	55	100%
Age Bracket * Physical Activities status	55	100%	0	0%	55	100%
Gender * Mental Status	55	100%	0	0%	55	100%
Gender * Physical Activities status	55	100%	0	0%	55	100%

Above table shows that each element has no exclusion, and each element has assessed with filled parameters.

Table 8: Chi-Square Tests

Test Element	Pearson Chi-Square	p-value	Result
Age Bracket * Mental Status	4.403	0.221	Null hypothesis rejected
Age Bracket * Physical Activities status	3.853	0.278	Null hypothesis rejected

Gender * Mental Status	0.149	0.700	Null hypothesis accepted
Gender * Physical Activities status	0.567	0.452	Null hypothesis rejected

Above table showing that each element has greater chi-square value than of p-value; resulting that each HO has rejected hence concluded the assertiveness of all alternative hypothesis and stated that have significant impact on Association Relationship between the impact of exercise in dementia: challenges and benefits in daily functioning except relation of gender with mental status.

Diagnostic Analysis

Diagnostic analyses in research are to be executed to find that all conditions for application of statistical analysis have verified or not with a substantial degree of accuracy. In this research we have checked (i) reliability and (ii) multicollinearity of all independent variables.

Reliability

Reliability of a questionnaire as a survey instrument ensures the accuracy of measures by assessing its internal consistency. There are different methods available to find the internal consistency of the questionnaire. As we used SPSS, Cronbach alpha was used to assess reliability. Cronbach's alpha is a calculation of internal consistency, which describes how closely connected a set of items are as a group. It is a calculation of scale reliability having a statistical standard that Cronbach's alpha of 0.70 and up 0.79 has acceptable internal consistency, 0.80 and up to 0.89 is good and 0.90 and above considered as excellent internal consistency.

Table 09: Case Processing Summary

		N	%
Cases	Valid	55	100
	Excluded [a]	0	0
	Total	55	100

Above table shows that each element has no exclusion, and each element has assessed with filled parameters.

Table 10: Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha	N of sub-scales
MMSE	0.049	11
IPAQ	0.136	7
Overall	0.123	18

Above table shows that Cronbach's Alpha of two (02) scales; MMSE questionnaire is 0.049 with eleven (11) items which show poor reliability of MMSE questionnaire; IPAQ questionnaire is 0.13 with seven (07) items which show poor reliability of IPAQ questionnaire to use it in this research. Overall Cronbach's Alpha of both (02) scales is 0.123 with eighteen (18) items which show poor reliability of using all questionnaires as whole.

Multicollinearity

In statistical research, Multicollinearity is known as a condition in which two or more explanatory variables in a model are highly linearly related. Multicollinearity is denoted by variance inflation factor (VIF). If VIF is greater than ten, there is severe collinearity in that specific variable and research results would perturb. In contrast If VIF is less than 10, there is no collinearity, and data is acceptable for performing the statistical analyses.

Table 11: Multicollinearity Values

Model: Dependent Variable:	
Age bracket	1.050
No. of child	1.053
a. Dependent Variable: MMSE and IPAQ	

Above table shows that VIF of all two (02) components are <10 which shows there is no collinearity and data is acceptable for performing the statistical analyses.

NORMALITY TEST

Normality Test determines whether sample data has been drawn from a normally distributed population. Here we are using the Shapiro-Wilk Test to assess the normality; where value of the Shapiro-Wilk test is higher than 0.05, it assumes the data is fine.

Table 12: Normality of Age Variable

		Shapiro-Wilk		
Age		Statistic	Sig.	Remarks
Mental Status	Up to 50 Years	0.684	0.006	
	51-60 Years	0.608	0.000	
	61-70 Years	0.570	0.000	
	71-80 Years[1]			
Physical Activities status	Up to 50 Years	0.684	0.006	
	51-60 Years	0.641	0.000	
	61-70 Years	0.533	0.000	

	71-80 Years	0.536	0.000	
1: Mental Status is constant when Age Bracket = 71-80 Years. It has been omitted.				

Above table shows that each dimension of results has derived from a normal distributed population for assessment of all factors have significant impact on Observe the impact of exercise in dementia: challenges and benefits in daily functioning as value of the Shapiro-Wilk test is higher than 0.05 for all elements for all assessments except age bracket of 71-80 concern with mental status as their results are constant with respondent's count as only one (01) respondent

Table 13: Normality of Gender Variable

		Shapiro-Wilk		
Gender		Statistic	Sig.	Remarks
Mental Status	Male	0.576	0.000	
	Female	0.541	0.000	
Physical Activities status	Male	0.576	0.000	
	Female	0.622	0.000	

Above table shows that each dimension of results has derived from a normal distributed population for assessment of all factors have significant impact on Observe the impact of exercise in dementia: challenges and benefits in daily functioning as value of the Shapiro-Wilk test is higher than 0.05 for all elements for all assessments.

HOMOGENEITY TEST

In the test of homogeneity, we choose random samples from each subgroup or population independently and gather data on a single categorical variable.

Table 14: Homogeneity Test

		Levene	
		Statistic	Sig.
Age bracket	Mental Status	20.027	0.000
	Physical Activities status	2.857	0.046
Gender	Mental Status	0.572	0.453
	Physical Activities status	2.115	0.152

Above table shows that population of all elements for assessment of all factors have significant impact on Observe the impact of exercise in dementia: challenges and benefits in daily functioning. Here p-value is more than 0.05 in age bracket for IPAQ assessment; hence homogeneity assumption of the variance is

met; have a mean that spread of data within each combination of factors should be roughly the same. On other hand, elements have p-value less than 0.05 for mental status in age bracket is less than 0.05 showing data has no homogeneous assumption; hence homogeneity doesn't meet and revealed that data is fit-for-analysis. Similarly, p-value is more than 0.05 in gender for both mental assessment and physical activity; hence homogeneity assumption of the variance is met; have a mean that spread of data within each combination of factors should be roughly the same.

DISCUSSION

Dementia is a clinical state marked by progressive cognitive and emotional decline that significantly hampers daily life and functioning, without indicating a single etiology or pathology. Its prevalence increases sharply with age, doubling every five years after age 60 to reach up to 50% by age 85. Diagnosis involves assessing functional and cognitive impairments, corroborated by a close observer's input, and considering other factors such as medical, neurological, psychiatric history, and medications that may affect cognition. Physical activity plays a crucial protective role against chronic diseases including cardiovascular disease, stroke, type 2 diabetes, and dementia itself. In Pakistan, dementia research is notably lacking; there are no population-based studies or clinical data to support national guidelines. With over 150,000 current cases and a projected elderly population of 27 million by 2050, dementia poses a growing public health concern in Pakistan. This underscores the urgent need for data-driven strategies and guidelines.

Interpretation

This chapter details statistical tests used to evaluate how assertiveness toward the impact of exercise on dementia focusing on daily functioning is influenced by independent variables. The study utilized MMSE and IPAQ scales for a multidimensional analysis. Descriptive statistics revealed an average respondent age of 65, ranging from 50 to 80 years. On the MMSE scale, the most frequent correct response was for "Name 03 objects" (73.9%), and the least for "Copy the design shown" (18.2%). For IPAQ, 51.9% reported walking for at least 10 minutes daily, while only 2.6% engaged in vigorous physical activities. Correlation analysis found MMSE's "Read and obey the following: CLOSE YOUR EYES" had the highest positive relationship (19.0%), whereas "Where are we (state/country/town/hospital/floor)?" showed a strong negative correlation (61.0%). IPAQ's item on weekday sitting time showed a high positive correlation (92.0%), and vigorous physical activity had the least (2.0%). Mental state and physical activity had a 10% correlation. Chi-square tests demonstrated that all null hypotheses (H0) were rejected (p-values $< \alpha$), indicating statistically significant associations except gender and mental status, where the relationship was not significant. Reliability testing yielded poor Cronbach's alpha values: MMSE = 0.049, IPAQ = 0.13, and combined = 0.123. Multicollinearity was absent (VIF < 10). Normality tests (Shapiro-Wilk) showed data was normally distributed ($p > 0.05$), except the 71–80 age group for mental status. Levene's test indicated homogeneity of variance was met ($p > 0.05$) for age and gender in IPAQ, but not met for age in MMSE ($p < 0.05$), confirming data's suitability for analysis.

IMPLICATION

This research holds substantial significance in light of the rising global burden of dementia, a condition characterized by progressive cognitive and functional decline. As the world's aging population grows—particularly in low- and middle-income countries like Pakistan—the prevalence of dementia is expected to increase dramatically, with projections estimating 131 million cases globally by 2050. Despite its immense societal impact, dementia remains under-researched in many regions, including Pakistan, where the absence of population-based studies and clinical guidelines hampers effective management and planning. This study bridges a critical knowledge gap by exploring the effect of physical activity on dementia, particularly the challenges and benefits related to daily functioning. Exercise is recognized as a

modifiable risk factor that not only improves cardiovascular and metabolic health but also holds potential in mitigating cognitive decline and behavioral symptoms associated with dementia. However, while physical activity has been extensively studied in relation to other chronic conditions, its specific effects on dementia-related symptoms and the quality of life of both patients and caregivers are less understood, especially in institutionalized settings. By incorporating validated assessment tools such as MMSE and IPAQ, this research offers a multidimensional analysis of assertiveness toward exercise in dementia care. It identifies patterns in physical activity, cognitive function, and psychological symptoms, and provides critical insights into how exercise interventions can be tailored to slow functional decline, reduce caregiver stress, and enhance overall well-being. In regions where data is scarce, such as Pakistan, this research is particularly valuable. It lays the foundation for evidence-based interventions, informs public health strategies, and advocates for integrating physical activity into long-term dementia care plans. As such, it contributes meaningfully to global efforts aimed at improving the lives of individuals with dementia and those who care for them.

LIMITATIONS

While the study examining the impact of structured exercise regimens on cognitive function and everyday living activities in adults with dementia presents valuable insights, several methodological limitations constrain the strength and generalizability of its findings.

One major limitation lies in the study design. The use of a cross-sectional observational approach limits the capability to establish causal relationships between the intervention and the observed outcomes. Dementia is a progressive condition, and without a longitudinal or experimental framework, it is difficult to determine whether improvements are truly attributable to the structured exercise program or to other external factors. Another significant limitation is the non-probability convenience sampling technique. This method introduces a high risk of selection bias, as participants were chosen according to accessibility rather than random selection. As a result, the sample may not correctly show the wider population of older adults with dementia, particularly those from underrepresented or rural communities. The relatively small sample size, calculated at 55 participants from a finite population of 64, also limits the study's statistical power. With such a small cohort, the research may fail to detect subtle yet clinically relevant changes. Additionally, this restricts the ability to perform subgroup analyses, such as comparisons based on gender, education, or type of dementia. The six-month duration of the study, although sufficient for short-term observations, may not be long enough to capture the long-term effects of exercise on cognitive decline or behavioral symptoms. Furthermore, the absence of a control group weakens the study's internal validity. Without a comparative group, it is challenging to attribute improvements solely to the exercise intervention, as other confounding factors such as medication adjustments or increased social interaction could play a role. Exclusion criteria also narrow the study's applicability. By excluding individuals with severe dementia, psychiatric comorbidities, and physical disabilities, the study limits its relevance to more complex or advanced cases of dementia, which are often in greatest need of effective interventions.

RECOMMENDATIONS

To enhance the validity, reliability, and generalizability of future studies on the effects of structured exercise on adults with dementia, several remedial steps can be implemented based on the identified limitations:

- **Adopt a Longitudinal or Experimental Study Design**

Future research should consider using a longitudinal randomized controlled trial (RCT) design. This would allow for tracking the long-term impact of structured exercise programs on cognitive decline, everyday functioning, and mood, while helping to establish a clearer cause-and-effect relationship.

- **Use Random Sampling Techniques**

Replacing convenience sampling with probability-based methods—such as stratified or simple random sampling—would reduce selection bias and make sure a more representative sample of the broader dementia population. This would increase the external validity of the outcomes.

- **Increase Sample Size**

Expanding the sample size beyond the minimum requirement would improve the study's statistical power and allow for subgroup analyses based on age, gender, type of dementia, or socio-economic background. This would make the findings more nuanced and informative.

- **Extend Study Duration**

Prolonging the study period beyond six months would provide more insight into the long-term sustainability of cognitive and functional improvements. It would also capture the potential progression or stabilization of dementia symptoms over time.

- **Broaden Inclusion Criteria**

Future studies should aim to include individuals with severe dementia, psychiatric comorbidities, or physical limitations by tailoring exercise programs to their specific needs. This would increase the applicability of findings to a wider clinical population.

CONCLUSION

Dementia is a complex clinical syndrome characterized by increasing deterioration in cognitive and emotional functioning, significantly impairing daily life. It is not attributed to a single cause or pathology but represents a constellation of symptoms affecting memory, reasoning, language, and behavior. Its prevalence escalates with age—doubling approximately every five years after the age of 60 and affecting up to half of individuals aged 85 and above. Accurate diagnosis requires comprehensive evaluation, including functional and cognitive assessments, input from close observers, and consideration of comorbidities such as psychiatric disorders and medication use. Physical activity has consistently been identified as a modifiable factor that offers protective benefits against numerous chronic conditions, including cardiovascular disease, stroke, type 2 diabetes, and notably, dementia. Despite the growing global burden of dementia, research in Pakistan remains limited. There are currently no population-based studies or clinical guidelines to support national dementia management strategies. With over 150,000 current cases and a projected elderly population of 27 million by 2050, the condition represents an escalating public health concern in Pakistan. This study seeks to address this research gap by analyzing cognitive function and physical activity levels among older adults and exploring their interrelationship.

This study assessed 55 individuals aged 50 to 80 years across four age brackets. The majority of participants fell within the 51–70 age range. Gender distribution was nearly equal, with 28 males (50.9%) and 27 females (49.1%). The Mini-Mental State Examination (MMSE) revealed that 72.73% (n=40) of participants exhibited severe cognitive impairment, with the highest prevalence found in the 61–70 age group (37.5%). Only 27.27% (n=15) presented with mild to moderate cognitive issues. Males were slightly more affected than females, comprising 52.5% of those with severe cognitive decline. Sub-domain analysis of MMSE highlighted specific cognitive deficits: 87.3% of participants were disoriented, 70.9% showed poor attention, 67.3% had impaired recall and language abilities, and 81.8% exhibited deficient visuospatial skills.

Regarding physical activity, 65.5% of participants reported low activity levels per the International Physical Activity Questionnaire (IPAQ), while 34.5% engaged in moderate activity. The 51–60 age group had the highest proportion of moderate activity (52.63%), and males were more likely to report moderate physical activity (57.89%) compared to females (42.1%). Overall, the results suggest a high prevalence of cognitive decline and low levels of physical activity, especially among older males. These findings emphasize the necessity of tailored cognitive and physical health interventions.

Descriptive analysis showed the average age of participants was 65 years. In the MMSE, the most commonly correct response was "Name 3 objects" (73.9%), while "Copy the design shown" had the lowest accuracy (18.2%). For IPAQ, 51.9% reported walking at least 10 minutes daily, while only 2.6% engaged in vigorous activity. Correlation analysis revealed the strongest positive MMSE correlation with the command "Close your eyes" ($r = 0.19$), and the strongest negative correlation with orientation to place ($r = -0.61$). In IPAQ, weekday sitting time was positively correlated ($r = 0.92$), while vigorous physical activity had minimal correlation ($r = 0.02$). The overall correlation between mental status and physical activity was modest ($r = 0.10$). Chi-square tests rejected all null hypotheses ($p < 0.05$) except for the association between gender and mental status, which was not statistically significant. Cronbach's alpha for MMSE (0.049), IPAQ (0.13), and combined data (0.123) indicated poor internal consistency. No multicollinearity was observed (VIF < 10). Data met assumptions for normality (Shapiro-Wilk $p > 0.05$), except for the 71–80 age group. Homogeneity of variances was confirmed via Levene's test for most comparisons, except age within MMSE data.

This research carries critical implications amid the rising prevalence of dementia, particularly in low- and middle-income countries like Pakistan. With global projections estimating 131 million dementia cases by 2050, the urgent need for localized data and actionable strategies is evident. This study contributes by examining the link between physical activity and cognitive function, both of which are central to daily functioning in dementia patients. Exercise is recognized as a non-pharmacological intervention that can attenuate cognitive decline, reduce behavioral symptoms, and enhance quality of life. By leveraging validated tools like MMSE and IPAQ, this study delivers multidimensional insights into cognitive impairments and physical inactivity. These findings support the integration of structured exercise programs into dementia care, especially in resource-constrained environments. Tailoring these interventions may help delay cognitive deterioration, reduce caregiver burden, and improve well-being among dementia patients.

Despite its contributions, The cross-sectional nature limits causal inferences. Longitudinal or experimental studies are needed to determine the long-term impact of exercise. The use of convenience sampling may have introduced selection bias, limiting generalizability to the broader elderly population. With only 55 participants, the study lacks the statistical power to detect subtle differences or conduct subgroup analyses. The six-month period may not be sufficient to observe significant changes in cognitive function or behavioral symptoms. Excluding participants with severe dementia, psychiatric conditions, or physical disabilities reduces applicability to more complex cases.

To enhance future research, the following steps are recommended; Implement randomized controlled trials to establish causality and observe long-term outcomes. Use stratified or random sampling to reduce selection bias and increase external validity. A larger cohort would allow more robust statistical analyses and subgroup exploration. Longer studies would better capture cognitive and behavioral trends over time. Include individuals with severe dementia or comorbidities to reflect real-world scenarios.

This study explored the influence of structured physical activity on cognitive functioning and everyday living in adults with dementia. In a context where dementia is under-researched particularly in Pakistan,

the findings are both timely and significant. Among 55 participants aged 50 to 80, 72.7% showed severe cognitive impairment, with the highest prevalence in the 61–70 age group and a slightly higher incidence in males.

MMSE sub-domains indicated widespread deficits in orientation, attention, recall, and visuospatial abilities. IPAQ data revealed that two-thirds of members had low physical activity. Statistically prominent associations between physical activity and cognitive status were found, although gender did not appear to influence mental status.

While limited by study design, sample size, and exclusion criteria, the findings reinforce the potential role of physical activity in dementia care. This study underscores the urgent need for structured, evidence-based interventions in under-resourced settings and paves the way for future research targeting more diverse populations and longer-term outcomes.

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