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PHYSICAL ACTIVITY AND ITS RELATIONSHIP WITH COGNITIVE LEVEL IN OLDER ADULTS FROM THE CITY OF DURANGO

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Abstract.: The population of older adults has been increasing worldwide. The health of older adults is often compromised by low levels of physical activity, combined with chronic diseases that, over time, contribute to both physical and mental deterioration. The objective of the present study was to determine the level of physical activity and its relationship with cognitive performance in older adults from the city of Durango. This is a descriptive, comparative, and correlational non-experimental study. A sample size of 119 adults aged 65 years and older was calculated, drawn from three centers in Durango City, Mexico: the Ciudad del Anciano (Elderly Home), the Cultural Center of the Mexican Institute of Social Security (IMSS), and the School for the Elderly of Durango City. Two validated instruments were applied: the International Physical Activity Questionnaire (IPAQ) and the Montreal Cognitive Assessment (MoCA). The results showed a relationship between vigorous physical activity and lower levels of cognitive impairment in the study sample. Observed a positive correlation between physical activity and favorable cognitive levels among older adults in the city of Durango. The findings clearly identified that vigorous physical activity provides the most significant protective benefits against cognitive decline. In conclusion, It is essential to consider the development of public health and epidemiological policies aimed at improving overall health through the promotion of vigorous physical activity among older adults residing in Durango.

Keywords: Physical Activity, Cognitive Decline, Older Adults.

Introduction

In the city of Durango, Mexico, the population of older adults has been steadily increasing. According to the 2022 Population and Housing Census conducted by the National Institute of Statistics and Geography (INEGI), there are a total of 75,853 older adults in the municipality of Durango, Mexico.

In Mexico, a person is considered an older adult from the age of 60. The continuous and growing increase in this demographic is reflected in official statistics, showing a gradual aging of the population and a steady rise in the number of elderly individuals.

Several studies have confirmed this demographic trend, such as those by Popolo (2011) and reports from the Economic Commission for Latin America and the Caribbean (ECLAC), which project that by the mid-21st century, population aging will continue gradually. This phenomenon results from a sustained decline in fertility rates and an increase in life expectancy. Various actions and agreements have been developed to promote objectives related to valuing aging and improving the quality of life of older adults, particularly through the Programme of Action of the International Conference on Population and Development.

On the other hand, aging is associated with a reduction in physical activity and a progressive tendency toward immobility, leading to an increased incidence of diseases that affect physical and mental health, functionality, and social life. This reduction in physical activity causes physiological and mental alterations that decrease the body's

ability to cope with pathological processes, thus accelerating aging.

The physical and mental health of older adults has always been an important component of national public health policies. Activities such as exercise programs, recreational and cognitive stimulation centers, and the promotion of healthy eating have had a strong impact on mitigating health problems in this specific population.

Several studies confirm the importance of physical activity among older adults, demonstrating that it is an effective strategy to protect body physiology, reverse certain pathological processes, and mitigate the effects of aging. Moreover, exercise can modify risk factors associated with chronic degenerative diseases, positively influence existing conditions, and improve psychological and social aspects, acting comprehensively on the overall health of older adults (Jara, L.R., 2015).

Among the older adult population, chronic degenerative diseases are increasingly common. Studies by Manrique-Espinoza et al. (2013) show that health problems among adults in Mexico are more frequent in those suffering from degenerative diseases such as hypertension, diabetes, respiratory problems, and coronary disease. Additionally, common conditions in this population include memory problems, hearing loss, reduced mobility, cataracts, and mild cognitive impairment, which can progress to mental illnesses such as depression, anxiety, or others.

Physical activity has been considered an effective strategy to counteract mobility, physical, and mental decline. Research by Castro-Jiménez, L.E. and Galvis-Fajardo, C.A. (2018) demonstrates that physical activity in older adults is a determining factor in preventing and slowing cognitive deterioration. Regular exercise significantly contributes to maintaining mobility, which positively affects quality of life. Various studies indicate that constant and vigorous physical activity not only prevents chronic diseases but also promotes recreational and social environments that enhance overall well-being. Although age-related changes are progressive and inevitable, scientific evidence suggests that the rate of cognitive decline can be modified through exercise-based interventions. Exercise also helps maintain and improve general physical condition, mental health, and blood pressure regulation in older adults, consolidating itself as a key tool for healthy aging.

Another study revealed that the increase in longevity, resulting from improved healthcare and living conditions, along with declining fertility rates, has contributed to longer life expectancy and a greater likelihood of aging free of disease. It was shown that physical activity positively influences ventilatory dynamics by increasing Peak Expiratory Flow values, thereby improving the body's functioning—particularly of the respiratory and musculoskeletal systems (Hernández, E., Jiménez, E., & Hernández, N., 2012).

The present study aims to identify the possible relationship between physical activity and cognitive level among older adults in the city of Durango, Mexico, located in three recreational and social centers: the *Ciudad del Anciano* (Elderly Home), the Social Security Center, and the School for the Elderly.

Problem Statement

The aging of the population in Mexico is a growing phenomenon that demands urgent attention from the Federal Government and the Ministry of Health. Current actions seek to address the challenges of healthcare for older adults. In this context, multicenter studies are essential to identify their real needs, as such information will allow for the design of more effective public health policies. The priority is to ensure comprehensive and adequate care for this sector of the population.

In Mexico, the population aged 65 and over has shown a sustained increase over recent decades, reaching an estimated 8.25% of the total population in 2024, according to data from the World Bank and other international statistical sources such as *TheGlobalEconomy* and the *OECD* (The World Bank, 2024; OECD / CEIC Data, 2023).

Population aging is a global phenomenon that has increased the prevalence of neurodegenerative diseases and cognitive disorders in older adults. Mild cognitive impairment (MCI) and dementias, such as Alzheimer's disease, currently represent some of the leading causes of disability and dependency in old age, affecting the quality of life of individuals, caregivers, and healthcare systems.

Various studies have identified that sedentary lifestyles are strongly associated with a higher risk of cognitive decline. In contrast, research has demonstrated that regular physical activity can exert a protective effect on cognitive function in older adults. For instance, a meta-analysis of randomized controlled trials found that aerobic exercise interventions lasting more than 12 weeks significantly improved global cognition among sedentary older adults (Zhao et al., 2022).

Moreover, longitudinal cohort studies have shown that physically active older adults have a lower risk of developing dementia, mild cognitive impairment, and diseases such as Alzheimer's. In a Canadian cohort, individuals with higher levels of physical activity showed a significant reduction in the risk of cognitive decline (Laurin et al., 2001).

Despite this evidence, many older adults still do not meet the minimum weekly physical activity recommendations, whether due to lack of information, physical or social barriers, or institutional limitations within public health systems. This gap between scientific evidence and daily practice represents a public health problem requiring urgent intervention.

This demographic trend reflects the ongoing process of population aging in Mexico, with significant implications for healthcare systems and public policy. The growing proportion of older adults has motivated numerous scientific investigations focusing on the main causes of morbidity and mortality in this age group. Various studies have documented the predominant diseases that affect the longevity and quality of life of Mexican older adults.

For example, the study *"Mortality inequality among older adults in Mexico"* (2010), based on death records, found that cardiovascular diseases represent the leading cause of death among adults aged 65 and over, with a prevalence of 23.8% in men and 25.1% in women. This is followed by diabetes mellitus (14.2% in men and 17.3% in women) and malignant tumors (13.0%

and 10.9% in men and women, respectively) (Wong, R., Michaels-Obregón, A., & Palloni, A., 2015). These findings are consistent with those of the longitudinal study *"Mortality and its association with chronic and infectious diseases"* (2001–2012), which identified the main causes of death among adults aged 50 and older as heart disease (20.1%), malignant tumors (18.6%), diabetes mellitus (16.2%), and cerebrovascular accidents (5.6%) (Samper-Ternent, R., Michaels-Obregón, A., Wong, R., & Palloni, A., 2016).

These non-communicable chronic diseases, closely linked to aging and the social determinants of health, continue to be the primary risk factors for mortality in old age. It is worth noting that during the critical period of the COVID-19 pandemic (2020–2021), a substantial shift was observed in the mortality profile of this age group. According to the study *"Excess mortality in Mexico during the COVID-19 pandemic"*, published in *Gaceta Médica de México*, COVID-19 became the leading cause of death in the country during those years, accounting for 21.7% of all deaths in 2021. During this period, ischemic heart disease and diabetes mellitus maintained significant prevalence rates (23.4% and 13.1%, respectively), followed by malignant tumors (8.2%) (Dávila-Cervantes, C. A., & Agudelo-Botero, M., 2022). Despite the pandemic's impact, chronic diseases persisted as structural causes of mortality in old age.

Taken together, these data indicate that Mexico's older adult population currently faces a dual epidemiological challenge: on one hand, the long-standing prevalence of chronic non-communicable diseases associated with aging; and on the other, vulnerability to public health emergencies such as the COVID-19 pandemic, which exacerbate existing risks. This scenario calls for comprehensive public health strategies focused both on prevention and specialized care for chronic diseases, as well as preparedness for emerging health events—while considering the sociodemographic and regional characteristics of this growing population.

Scientific evidence highlights the urgent need for public policies that prioritize healthy aging, timely access to specialized medical services, and the reduction of health inequalities that disproportionately affect older adults—particularly those living in poverty or with low educational attainment, who present higher rates of premature mortality.

In summary, older adults in Mexico, who now represent just over 8% of the total population (The World Bank, 2024), constitute a priority group for the design of social, health, and economic policies, given the complexity of their health profile and their growing demographic significance within the national population structure.

For these reasons, regular physical activity is considered the "secret weapon" to feel better, live longer, and slow down the aging process. Moreover, it helps prevent diabetes, cardiovascular diseases, and forms part of the treatment for arthritis, anxiety, and depression—health problems commonly affecting older adults.

The present research aims to address the following question:

Is there a relationship between physical activity and the prevention of cognitive decline among older adults in the city of Durango?

Objective: To determine the level of physical activity and its relationship with

cognitive performance among older adults in Durango City, Mexico.

Hypothesis: There is a relationship between moderate and vigorous physical activity and favorable cognitive outcomes among older adults in Durango City, Mexico.

Theoretical Framework

Some definitions of aging refer to a series of morphological, psychological, functional, and biochemical modifications that occur over time in living beings. According to research by Villafuerte, J. et al. (2017) on the *well-being and quality of life of older adults: a challenge for intersectoral action*, aging is characterized as the progressive loss of the organism's reserve capacity in response to change. It is a dynamic process that begins at birth and continues throughout life. The differences observed in the way individuals age are largely the result of psychosocial factors, and not exclusively biological ones. Villafuerte et al. (2017) also note that during the World Assembly on Aging, held in Vienna in 1982, the elderly population was defined as individuals aged 60 years and over. It is well known that not all people age in the same way; therefore, chronological age can serve as a useful but not necessarily precise indicator, as each individual seems to have a unique pace of aging.

The geriatric population brings an increase in both social and economic costs, since age represents a major risk factor for disabling diseases, among which neurocognitive disorders stand out.

According to Vega-López, V. E. (2021), *cognition* refers to intellectual functioning that enables us to interact with others and provides the capacity to solve problems that arise in our environment. Cognitive screening is a type of assessment performed through the application of short scales, designed to obtain a general overview of the patient's neuropsychological or cognitive performance.

Instruments such as the Montreal Cognitive Assessment (MoCA), developed and validated by Nasreddine, Z. et al. (2005), are suitable tools for researchers seeking to ensure early detection of cognitive problems. Examples of such applications include studies on low cognitive performance screening related to alcohol consumption. For instance, Pérez-Sosa, K. L., Lares-Bayona, E. F., and Herrera-Vargas, I. V. (2019) found that cognitive impairments due to alcohol consumption among university students in Durango, Mexico, were significantly higher in the female population. Therefore, the MoCA test is considered a validated instrument for assessing cognitive levels in adult populations.

Physical activity remains an ideal strategy for maintaining good health in adult populations. Although health problems become more frequent with aging, physical activity continues to serve as an effective public health strategy, managed by health institutions to preserve mobility and promote both physical and mental well-being in this vulnerable population, thus contributing to better quality of life in old age.

Several instruments exist to measure physical activity levels among older adults. One of the most widely used is the International Physical Activity Questionnaire (IPAQ), developed in 1998 by an international group of experts convened by the World Health Organization (WHO) and the Centers for Disease Control and Pre-

vention (CDC). The initiative aimed to standardize the measurement of physical activity levels at the population level. The questionnaire's design was overseen by the International Consensus Group on Physical Activity Measurement, with the objective of creating a valid, reliable, and culturally adaptable self-report tool (IPAQ Research Committee, 2005).

The international validation of the IPAQ was carried out between 2000 and 2002 in multicenter studies across more than 12 countries, including Brazil, Colombia, Canada, the United States, Finland, and Sweden. The validation process was led by the Karolinska Institutet (Sweden), in collaboration with various universities and public health institutions. The results were published in 2003 in the journal *Medicine & Science in Sports & Exercise*, demonstrating satisfactory test–retest reliability and acceptable concurrent validity when compared to objective measures such as accelerometers (Craig, C. L. et al., 2003).

The IPAQ, available in both short and long forms, has been widely used in epidemiological studies and physical activity surveillance due to its adaptability and ease of administration across diverse populations (Bauman, A. et al., 2011).

In the study *"Diagnosis of physical activity through the IPAQ questionnaire during the COVID-19 pandemic"* by Bonifaz-Arias, I. G., Trujillo-Chávez, H. S., Cando-Brito, J. K., & Pazmiño-Secaira, S. R. (2017), the authors found that assessing physical activity during the COVID-19 pandemic served as a protective factor against chronic degenerative diseases. The study applied an analytical, descriptive, and explanatory methodology using the IPAQ to monitor walking and moderate-to-vigorous physical activity before and after an intervention program consisting of various physical exercises with 124 business administration students (both men and women) during the first and second quarters of 2022. The pre-test data were analyzed to establish metabolic equivalent (MET) indices and categorize participants by activity level. After the intervention, a post-test IPAQ assessment was performed, and the results showed that the intervention program positively influenced students' health through a consistent increase in vigorous physical activity.

Multiple studies have confirmed that the IPAQ questionnaire reliably associates physical activity with both mental and physical health outcomes across age groups. The instrument provides quantitative information about activity levels in adult populations. Research by Toloza & Gómez-Conesa (2007) demonstrated the tool's validity, reporting a reliability coefficient of r = 0.8 with a 95% confidence interval ranging from 0.79 to 0.82 when applied to adult populations.

Methodology

This research follows a quantitative, descriptive-comparative design. A total sample of 119 older adults was obtained from three recreational centers in the city of Durango, Dgo., Mexico: *Ciudad del Anciano, the Mexican Institute of Social Security (IMSS) Recreational Center, and the School for the Elderly.*

Participants were randomly selected and completed a survey after providing written informed consent, ensuring confidentiality and alignment with the study's objectives.

The sample size was calculated using the finite population proportion formula, based on the estimated number of older adults regularly attending the three participating centers.

A total of 192 older adults were initially considered, proportionally distributed among the following centers:

- *Ciudad del Anciano*, Durango, Dgo.
- *IMSS Recreational Center*, Durango, Dgo.
- *School for the Elderly*, Durango, Dgo.

For this estimation, a 95% confidence level, an assumed proportion (p = 0.50)—given the lack of prior data on the prevalence of cognitive decline among older adults—and a 5% margin of error were applied.

All participants signed an informed consent form, in accordance with Articles 21, 22, and 23 of the Reglamento de la Ley General de Salud en Materia de Investigación (Regulation of the General Health Law on Research) in Mexico. Ethical standards concerning privacy, voluntary participation, and confidentiality were strictly followed.

Both questionnaires (MoCA and IPAQ) were administered to adults aged 60 years and older at the following locations:

- *Ciudad del Anciano*
- *School for the Elderly*
- *IMSS Recreational Center (CSS)*

Data collection was conducted on-site by trained researchers to ensure consistency and validity in responses.

A descriptive statistical analysis was performed to explore the relationship between cognitive decline and physical activity.

- Qualitative variables were analyzed using cross-tabulations, reporting frequencies and percentages.
- Quantitative variables were analyzed using means and standard deviations.

For inferential statistics, Kendall's Tau-c test was applied to examine potential associations between the ordinal qualitative variables of interest.

All data were processed using IBM SPSS Statistics, version 24 (licensed).

Results

The study sample consisted of 120 older adults. The mean age was 70.18 ± 7.12 years, ranging from 60 to 95 years. The gender distribution showed 66.4% female and 33.6% male participants. Regarding occupation, the most representative categories were pensioners (41.2%), retirees (24.4%), and homemakers (20.2%); while employees (7.6%) and other occupations (6.7%) represented the remaining groups.

Concerning educational level, the most frequent category was secondary school (31.9%), followed by primary school (26.9%), bachelor's degree (19.3%), and high school (18.5%). Most participants (96.6%) were born in the state of Durango, while 3.4% were born elsewhere.

Physical Activity Levels

Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ), validated by the Karolinska

Institute (Sweden). Results indicated that 47% of participants engaged in vigorous activity, 37% in moderate activity, and 16% were sedentary (Table 1).

Physical Activity Level	Frequency	Percentage
Sedentary	19	16.0%
Moderate	44	37.0%
Vigorous	56	47.0%
Total	119	100.0%

Table 1. Physical activity levels among older adults in the city of Durango.

Distribution by Institution

Participants were distributed across three centers in the city of Durango: Ciudad del Anciano (25.2%), the Social Security Recreational Center (CSS) (58.8%), and the School for the Elderly (16.0%).

The breakdown of physical activity levels by center was as follows:

In *Ciudad del Anciano*, 43.3% performed moderate activity, 30% were sedentary, and 26.7% performed vigorous activity.

In CSS, 11.4% were sedentary, 32.9% moderate, and 55.7% vigorous.

In the *School for the Elderly*, 10.5% were sedentary, 42.1% moderate, and 47.4% vigorous (Table 2).

Institution	Activity Level	Frequency	Percentage
Ciudad del Anciano	Sedentary	9	30.0%
	Moderate	13	43.3%
	Vigorous	8	26.7%
CSS	Sedentary	8	11.4%
	Moderate	23	32.9%
	Vigorous	39	55.7%
School for the Elderly	Sedentary	2	10.5%
	Moderate	8	42.1%
	Vigorous	9	47.4%

Table 2. Physical activity level classification by institution in the city of Durango.

Cognitive Impairment Levels

Cognitive status was evaluated using the Montreal Cognitive Assessment (MoCA), with scores below 26 points considered indicative of cognitive impairment. Among the total sample, 60.5% showed signs of cognitive impairment, while 36.1% presented no impairment (Table 3).

Cognitive Status	Frequency	Percentage
With cognitive impairment	72	60.5%
Without cognitive impairment	43	36.1%
Total	115	96.6%

Table 3. Cognitive impairment among older adults in the city of Durango.

By institution, the highest prevalence of cognitive impairment was observed at the CSS (64.3%), followed by Ciudad del Anciano (60.0%), and the School for the Elderly (47.4%) (Table 4).

Institution	Cognitive Status	Frequency	Percentage
Ciudad del Anciano	With impairment	18	60.0%
	Without impairment	10	33.3%
CSS	With impairment	45	64.3%
	Without impairment	24	34.3%
School for the Elderly	With impairment	9	47.4%

Institution	Cognitive Status	Frequency	Percentage
	Without impairment	9	47.4%

Table 4. Cognitive impairment by institution among older adults in Durango.

Correlation Between Physical Activity and Cognitive Function

A significant correlation was identified between physical activity levels and cognitive evaluation categories as measured by the MoCA. Higher levels of vigorous physical activity were positively associated with the absence of cognitive impairment.

Specifically, among participants engaging in vigorous activity, 52.7% showed no cognitive impairment. In contrast, 82.4% of sedentary participants and 74.4% of those with moderate activity presented cognitive impairment. This relationship was statistically significant (p = 0.000279) (Table 5).

Cognitive Status		Physical Activity Level			Kendall's Tau-c	p-value
		Sedentary	Moderate	Vigorous		
With cognitive impairment	n	14	32	26	0.319	0.000279
	%	82.4	74.4	47.3		
Without cognitive impairment	n	3	11	29		
	%	17.6	25.6	52.7		

Table 5. Relationship between physical activity and cognitive evaluation among older adults in Durango.

Epidemiological Risk Analysis

Further analysis revealed that vigorous physical activity acts as a protective factor against cognitive impairment. The Prevalence Odds Ratio (ODS) for vigorous activity was 0.436 [95% CI: 0.259–0.732], statistically significant, indicating a 56% reduction in the probability of developing cognitive impairment. The lower bound of the 95% confidence interval suggests a potential 74% reduction in risk (Table 6).

By institution, Ciudad del Anciano and CSS both showed significant protective effects with ODS values of 0.267 and 0.260, respectively. The School for the Elderly, however, did not show a statistically significant association (Table 6).

Group	ODS	95% Confidence Interval
Total Sample	0.436	(0.259 – 0.732)
Ciudad del Anciano	0.267	(0.102 – 0.699)
Social Security Center (CSS)	0.260	(0.099 – 0.681)
School for the Elderly	1.350	(0.555 – 3.283)

Table 6. Prevalence odds ratios (ODS) for absence of cognitive impairment and vigorous physical activity as a protective factor among older adults in Durango.

Discussion

Epidemiological results suggest a relationship between physical activity and cognitive benefits in older adult populations. Studies conducted by Yan et al. (2022) identified a positive effect on cognition among sedentary older adults following a physical activity intervention lasting more than 12 weeks, with a reported risk of 0.50 and a 95% confidence interval (CI) of 0.09–0.92.

Similar findings were observed in the present study, with a risk of 0.436 and a 95% CI of 0.259–0.733, both statistically significant, identifying physical activity as a protective factor against cognitive decline in older adults.

Other descriptive research studies have reported high percentages of cognitive impairment among older adults, with a prevalence of up to 84%, according to Sánchez-Nieto and Mendoza-Núñez (2020). In contrast, the present investigation found a lower prevalence of 60.5%. Although this is below the previously reported rate, it may be attributed to the fact that recreational and social centers for older adults in the city of Durango implement strategies to prevent cognitive decline through both recreational and physical activities. Therefore, the lower prevalence observed in this study can be justified by the preventive influence of structured physical engagement within these community programs.

Vigorous physical activity appears to be the most effective in preventing cognitive deterioration. According to the present findings, 52.7% of participants who engaged in vigorous physical activity exhibited better cognitive performance. Consequently, nearly half of the participants who did not perform vigorous activity—including those who maintained sedentary or moderate levels—did not experience significant cognitive benefits. This finding aligns with the results reported by Nieto and Mendoza-Núñez (2020), who emphasized that physical activity must be consistent and maintained for periods exceeding 12 weeks to achieve measurable cognitive improvements.

Conclusions

In conclusion, the present study observed a positive correlation between physical activity and favorable cognitive levels among older adults in the city of Durango. The findings clearly identified that vigorous physical activity provides the most significant protective benefits against cognitive decline.

Among the participating centers, the School for the Elderly showed the highest percentage of individuals without cognitive impairment, while both the Mexican Social Security Institute (IMSS) and the City of the Elderly presented proportions slightly above one-third of their populations without deterioration. Regarding the level of vigorous physical activity, the IMSS recreational center had slightly more than half of its participants engaging in such activity, whereas the School for the Elderly had almost half, and the City of the Elderly reported only about one-fifth participation. Therefore, vigorous physical activity remains relatively uncommon among older adults in Durango, which may pose potential future health challenges for this population.

Cognitive impairment represents a significant public health and epidemiological concern, as it can affect individuals at any age; however, it is most prevalent among older adults. According to this study, a 60.5% prevalence of cognitive impairment was identified—nearly two-thirds of the study population.

It is essential to consider the development of public health and epidemiological policies aimed at improving overall health through the promotion of vigorous physical activity among older adults residing in Durango. Such interventions could enhan-

ce various dimensions of cognitive functioning, including memory, attention, reasoning, logic, and verbal fluency.

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