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REVIEW

Cognitive impairment and cognitive reserve in a rural community in the state of Oaxaca, Mexico

Deterioro y reserva cognitiva en una comunidad rural del Estado de Oaxaca, México

Comprometimento cognitivo e reserva cognitiva em uma comunidade rural do estado de Oaxaca, México

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Abstract

Introduction: Aging is a global phenomenon associated with an increase in neurodegenerative diseases such as cognitive impairment. These diseases affect the autonomy and quality of life of older adults. In this context, cognitive reserve is important because it enables the brain to maintain its functionality despite pathologies thanks to the adaptability of its neural networks. The role of nursing plays a key part in the early detection of cognitive impairment at the first level of care, through the use of comprehensive geriatric assessments, as well as the promotion of activities that strengthen cognitive reserve, such as exercise, leisure activities, and a healthy diet. **Objective**: To analyze the relationship between cognitive reserve and the development of cognitive impairment

in older adults living in San Jerónimo Yahuiche, Oaxaca, México. **Methodology**: A descriptive-correlational study was carried out with 51 Spanish-speaking adults aged over 60 years and living in the local area, who had signed an informed consent form. The Montreal Cognitive Assessment and the Cognitive Reserve Scale were administered, and Chi-square, ANOVA and Mann-Whitney U tests were performed. **Results**: Most of the participants were women with an average age of 65.6 years. Of these, 31.4 % were bilingual, married and had a low level of education. 52.9 % had low cognitive reserve, while 45.1 % had mild cognitive impairment. No significant statistical association was found between demographic variables, cognitive reserve and cognitive impairment ($p > 0.05$). **Conclusions**: Although we did not find a direct relationship between cognitive reserve and impairment, certain factors could influence its development in older adults lacking protective factors. More studies are required to delve deeper into this relationship and its impact on the prevention of neurocognitive diseases.

Keywords: Older adults; Cognitive reserve; Cognitive impairment; Dementia (DeCS).

Resumen

Introducción: El envejecimiento es un fenómeno global asociado a un aumento en enfermedades neurodegenerativas como el deterioro cognitivo, que afectan la autonomía y calidad de vida de los adultos mayores. En este contexto, la reserva cognitiva adquiere relevancia al permitir al cerebro mantener su funcionalidad ante patologías, gracias a la adaptabilidad de sus redes neuronales. Enfermería juega un papel clave en la detección oportuna del deterioro cognitivo en el primer nivel de atención, mediante valoraciones geriátricas integrales y promoción de actividades que fortalezcan la reserva cognitiva, como el ejercicio, el ocio o la dieta saludable. **Objetivo:** Analizar la relación entre la reserva cognitiva y el desarrollo de deterioro cognitivo en adultos mayores de San Jerónimo Yahuiche, Oaxaca, México. **Metodología:** Estudio descriptivo, correlacional en 51 adultos mayores a 60 años, residentes del lugar, que hablaban español, quienes firmaron consentimiento informado, se aplicó Evaluación Cognitiva de Montreal y Escala de Reserva Cognitiva, se realizaron pruebas Chi cuadrada, ANOVA, y U de Mann-Whitney. **Resultados:** La mayoría fueron mujeres, edad promedio 65.6 años; 31.4 % bilingües, casados, con nivel educativo bajo. 52.9 % presentó baja reserva cognitiva y 45.1 % deterioro leve. No hubo asociación estadística significativa entre variables demográficas, reserva y deterioro cognitivo ($p > 0.05$). **Conclusiones:** Aunque no se encontró una relación directa entre reserva y deterioro cognitivo, ciertos factores podrían influir en la construcción de reserva cognitiva en adultos mayores sin factores protectores. Se requieren más estudios para profundizar en esta relación y su impacto en la prevención de enfermedades neurocognitivas.

Palabras clave: Adulto mayor; Reserva cognitiva; Deterioro cognitivo; Demencia (DeCS).

Abstrato

Introdução: O envelhecimento é um fenómeno global associado ao aumento de doenças neurodegenerativas, como o declínio cognitivo, que afetam a autonomia e a qualidade de vida dos idosos. Neste contexto, a reserva cognitiva torna-se relevante por permitir ao cérebro manter a sua funcionalidade perante patologias, graças à adaptabilidade das suas redes neuronais. A enfermagem desempenha um papel fundamental na deteção atempada do declínio cognitivo ao nível dos cuidados primários, através de avaliações geriátricas abrangentes e da promoção de atividades que reforcem a reserva cognitiva, como o exercício, o lazer ou a alimentação saudável. **Objetivo:**

Analisar a relação entre a reserva cognitiva e o desenvolvimento do declínio cognitivo em idosos de San Jerónimo Yahuiche, Oaxaca, México. **Metodologia:** Foi realizado um estudo descritivo e correlacional em 51 adultos de língua espanhola com mais de 60 anos, residentes na área, que assinaram o consentimento informado, foram aplicadas a Avaliação Cognitiva de Montreal e a Escala de Reserva Cognitiva foram realizados os testes do qui-quadrado, ANOVA e U de Mann-Whitney. **Resultados:** A maioria eram mulheres, com uma média de idades de 65,6 anos; 31,4% eram bilingues, casados e tinham um baixo nível educacional. 52,9 % apresentavam baixa reserva cognitiva e 45,1 % apresentavam comprometimento ligeiro. Não se verificou associação estatisticamente significativa entre as variáveis democráticas, a reserva e o défice cognitivo (p> 0,05). **Conclusões:** Embora não tenha sido encontrada uma relação direta entre a reserva e o défice cognitivo, certos fatores podem influenciar o desenvolvimento da reserva cognitiva em idosos sem fatores de proteção. Mas estudio ta nesesario pa profundisá mas den e relashon aki i su impakto riba prevenshon di malesanan neurokognitivo.

Palavras-chave: Idosos; Reserva cognitiva; Comprometimento cognitivo; Demência (DeCS).

Introduction

The ageing of the population is advancing rapidly due to an increase in life expectancy and a decrease in fertility. This is increasing the proportion of people over 60 years of age in almost all countries [(1)]. As people age, they are at an increased risk of cognitive impairment, such as memory loss, impaired reasoning and language difficulties, which can lead to neurocognitive disorders (NCDs), which affect the quality of life and autonomy of older adults. NCDs are characterized by an acquired impairment of cognitive function that is not present from birth. A mild neurocognitive disorder is referred to as cognitive impairment (CI), while a major NCD is referred to as dementia [(2)]. This study focuses on cognitive impairment because it is a better recognized and earlier diagnosed condition. The prevalence of cognitive impairment increases with age and often occurs alongside chronic diseases such as diabetes mellitus (DM), arterial hypertension (AHT) or depression, which can hinder early detection. Often, its manifestations are mistaken for normal signs of ageing, resulting in delayed diagnosis and preventing early intervention to mitigate deterioration.

The progression of cognitive impairment can vary considerably from person to person. While some people reach advanced ages fully autonomous despite brain damage and significant pathologies, others do not. Several studies [3] demonstrate that people with greater cognitive reserve (CR) can better manage degenerative brain changes associated with dementia or other brain diseases.

In 2021, the World Health Organization estimated that over 55 million people worldwide were living with dementia, with a higher prevalence among women over 65. In the Americas region, 10.3 million cases were reported [4]. In Mexico, it is estimated that approximately 1.3 million people suffer from Alzheimer's disease, representing 60 and 70 % of dementia cases and primarily affecting individuals over the age of 65 [5]. In Oaxaca, the incidence rate is 1.2 cases per thousand adults over 60 years of age [6].

The CR is defined as the brain's ability to withstand the effects of neurological pathologies associated with neurocognitive disorders, thereby delaying the onset of clinical symptoms [3]. This concept is important because it acts as a protective factor against neurodegenerative diseases, which impact not only patients' autonomy, but also the quality of life of their caregivers.

Research in developed countries has shown that CR is built throughout life through protective factors such as education, physical activity, social participation, and a healthy diet [3,7]. However, communities in areas with poor socioeconomic conditions, such as San Jerónimo Yahuiche in Oaxaca, Mexico, face structural limitations that hinder access to these resources. This could have a negative impact on their ability to develop a solid cognitive reserve. This community has low educational levels, high levels of marginalization, and limited access to healthcare, depriving them of key factors in the prevention of neurocognitive disorders. This context raises the need to investigate how these conditions influence CR and the development of cognitive impairment, as well as identifying any other, less conventional protective factors that are adapted to their reality. Consequently, the following research question is posed: Is there a relationship between CR and the

development of cognitive impairment in older adults in San Jerónimo Yahuiche between July 2021 and July 2022?.

Additionally, nursing plays a fundamental role in the initial care of older adults, facilitating the timely detection of cognitive impairment through geriatric assessment instruments and promoting habits that strengthen cognitive reserve. Thus, the aim of this study is to provide an overview of the cognitive status of a vulnerable population and support the planning of specific intervention strategies. The primary aim was to assess the relationship between CR and the development of cognitive impairment in older adults in San Jerónimo Yahuiche, Oaxaca, México.

Methodology

A quantitative study with a cross-sectional, non-experimental design was conducted with an exploratory, descriptive and correlational focus. The study population was comprised by 58 older adults from San Jerónimo Yahuiche, a municipal office in Santa María Atzompa, Oaxaca, Mexico. The sample size was estimated using the formula for finite populations, with a confidence level of 95 %, a margin of error of 5 %, and an expected proportion of the population of 50%. This determined a representative sample of 51 older adults, selected using simple random sampling.

The inclusion criteria was comprised by individuals over 60 years of age who lived in the community and spoke Spanish. Those with any disability that would hinder communication and those who refused to participate in the survey or sign the informed consent form were excluded.

The main variables used in this study were sociodemographic and general data, as well as cognitive impairment and cognitive reserve.

The data collection instrument included an identification form to gather sociodemographic data, such as age, sex, education, occupation and marital status. To assess cognitive status, the Spanish version of the Montreal Cognitive Assessment (MoCA) [8], which has been validated in the Mexican population [9], was administered. It has a Cronbach's alpha reliability of 0.89. The test

explores six cognitive domains (attention and concentration, executive functions, memory, language, visuoconstructive/visuospatial skills and orientation) and takes approximately 10 minutes to complete. A score of 26 or higher is considered normal.

To measure cognitive reserve, the Cognitive Reserve Scale developed by León, et al., [10] was used. This scale consists of 24 items organized into four dimensions: Activities of daily living; education/information; hobbies/interests; and social life (Cronbach's α= 0.77). The scale assesses three life stages: Youth (18-35 years), adulthood (36-64 years) and old age (65 years and over), using a five-point Likert scale. The total score is obtained by direct summation, whereby a lower score indicates a higher level of cognitive reserve. With the authors' permission, the age ranges were adjusted to include older adults aged 60 and over, in accordance with Mexican criteria, unlike the original instrument which was validated in Spain. The adapted version showed adequate reliability (Cronbach's α= 0.82).

Regarding ethical considerations, authorization was obtained from the university Research Ethics Committee (CEI-017A/2020) in accordance with the general health law regulations on health research. Similarly, the necessary permissions were obtained from the San Jerónimo Yahuiche community. The privacy of the collected data was guaranteed in the informed consent form.

Descriptive data analysis was performed using the statistical tools Microsoft Excel and JASP version 0.16.3.0, with frequency distribution and percentage calculations. For the correlational assessment, the chi-squared test was used to examine the association between categorical variables. The ANOVA, Mann-Whitney U and Shapiro-Wilk tests were then applied, depending on the nature of the variables and compliance with statistical assumptions.

Results

Of the total number of participants, 66 % were female. The median age was 64, representing 21.5 % of the sample. The recorded ages ranged from 60 to 76 years old, with an average of 65.6 years.

Similarly, 54.9 % of the participants were over 65 years of age. Conversely, 31.4 % reported speaking an indigenous language, and 96 % indicated that they were married. Finally, 64.7 % of participants had a low level of education.

In terms of the gender distribution of cognitive reserve, 66 % of participants were female. However, there was greater dispersion in CR scores within the male group, with an inter-quartile range (IQR) of 28.0, suggesting greater variability in CR levels.

In terms of educational level, the group with secondary education showed the greatest dispersion, with an IQR of 30.0 indicating the highest variability in CR levels, (Table 1).

Table 1: Demographic characteristics and their association with cognitive reserve, 2021- 2022 (n=51)

Variables	F	%	Mean	SD	Median	IQR
Sex:						
Female	34	66.7	153.6	22.1	145.0	22.0
Male	17	33.3	150.8	21.6	146.0	28.0
Age:						
Adult	23	45.0	156.6	22.8	152.0	23.5
Older adult	28	54.9	149.4	20.7	142.0	26.0
Mother tongue/bilingualism:						
Yes	16	31.4	161.8	19.0	157.50	21.0
No	35	68.6	148.5	21.9	141.0	24.0
Marital status:						
Married	49	96.1	151.2	20.8	144.0	23.0
Widow/widower	2	3.9	188.0	15.6	188.0	11.0
Level of education:						
Low (<6 years)	33	64.7	151.1	20.3	144.0	24.0
Secondary (6-12 years)	9	17.7	161.4	24.1	152.0	30.0
High (> 12 years)	9	17.5	149.4	24.9	141.0	19.0

Source: Self-developed

In terms of cognitive impairment, 45.1 % of older adults were found to have mild impairment, while 54.9 % had normal cognitive function.

Table 2 shows that the greatest dispersion of cognitive impairment scores occurs in the highly educated group. However, on average there were no significant changes in mean scores by educational level, indicating that educational level does not have a strong impact on MoCA's results.

However, when marital status was considered, it was found that married adults achieved an average MoCA's score that was over two points higher than that of adults without a partner. No significant differences were detected in the mean MoCA's scores between men and women, indicating that cognitive impairment did not substantially vary by gender in this sample. However, a notable difference was seen based on age: Adults aged 60-64 obtained a higher average score than those aged over 65. No significant statistical associations were found between the mean CR and impairment scores and the demographic variables.

Table 2: Demographic characteristics and their association with cognitive impairment, 2021-2022 (n=51)

Variables	MoCA					
	f	%	Mean	SD	Median	IQR
Sex:						
Female	34	66.7	25.3	2.9	26.0	3.0
Male	17	33.3	25.5	1.9	26.0	3.0
Age:						
Adult	23	45.1	26.4	1.5	26.0	2.0
Older adult	28	54.9	24.5	3.0	25.0	4.2
Mother tongue/bilingualism:						
Yes	16	31.4	26.4	1.5	27.0	3.0
No	35	68.6	24.9	2.9	26.0	3.0
Marital status:						
Married	48	96.1	25.4	2.6	26.0	3.0
Widow/widower	2	3.9	24.0	4.2	24.0	3.0
Level of education:						
Low	33	64.7	24.8	2.9	26.0	3.0
Secondary	9	17.6	26.1	1.1	26.0	2.0
High	9	17.5	26.7	2.2	28.0	3.0

Source: Self-developed

Table 3 shows the results of the independence test used to assess the relationship between medical history and CR levels. The results indicated that there was insufficient statistical evidence to conclude that the two variables were significantly related. Furthermore, it was seen that median CR did not change significantly between different medical history groups, suggesting that these conditions do not significantly affect the participants' CR level.

In terms of data dispersion, the group with the greatest variability was those who reported visual problems, with an IQR of 36 indicating greater heterogeneity in CR levels within this group. By

contrast, the group with the lowest dispersion was those who reported arthritis, suggesting greater homogeneity in CR levels among participants with this condition.

Table 3: Medical history and its association with cognitive reserve, 2021-2022 (n=51)

Medical history (%)	Absence of cognitive reserve				Presence of cognitive reserve				Statistics: p value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	
Hypertension n=34 (66.7)	148.5	19.2	144.0	17.0	154.7	22.9	147.5	27.0	W=245.50 p= 0.344
Diabetes mellitus n=10 (19.6)	153.7	21.8	146.0	24.0	148.5	22.0	142.5	19.5	W=233.50 p=0.507
Arthritis n=12 (23.5)	154.6	23.3	147.0	25.5	146.3	14.5	142.0	17.0	W: 277.50 p=0.248
Hearing impartment n=5 (9.8)	153.1	22.4	146.0	24.3	148.8	16.0	141.0	18.0	W=125.00 p=0.681
Vision impairment n=9 (15.8)	150.4	20.1	145.0	23.5	163.0	27.1	157.0	36.0	W=137.50 p=0.117

Source: Self-developed

Table 4 shows the results of the statistical assessment evaluating the relationship between medical history and cognitive impairment. Notably, diabetes mellitus showed a statistically significant association (p= 0.003), suggesting that this medical condition may be linked to an increased risk of cognitive impairment in the study population. Regarding the dispersion of MoCA's scores according to medical history, it was seen that hypertension showed the greatest variability in the group with cognitive impairment, with an inter-quartile range (IQR) of 3.5. This indicates greater heterogeneity in the scores. Conversely, arthritis showed the greatest dispersion in the group without cognitive impairment, with an IQR of 3.5. By contrast, diabetes mellitus showed the least dispersion (IQR= 1.75), suggesting greater homogeneity in the results among people with this condition.

Table 4: Medical history and its association with cognitive impairment, 2021-2022 (n=51)

Medical history (%)	Absence of cognitive impairment				Presence of cognitive impairment				Statistics: p value
	Mean	SD	Median	IQR	Mean	SD	Median	IQR	
Hypertension n=34	24.5	2.9	25.0	2.0	25.8	2.4	26.0	3.5	W=202.500 p=0.112
Diabetes mellitus n=10	25.8	2.6	26.0	3.0	23.5	1.7	23.5	1.8	W=338.000 p=0.003
Arthritis n=12	25.3	2.9	26.0	3.5	25.6	1.7	25.5	2.2	W=241.000 p=0.731
Hearing impartment n=5	25.2	2.7	26.0	3.0	26.6	1.9	26.0	2.0	W=82.000 p=0.266
Vision impairment n=9	25.2	2.6	26.0	3.0	26.0	2.5	26.0	3.0	W=155.500 p=0.419

Source: Self-developed.

A one-factor ANOVA test was applied to assess whether there were significant differences in the means of CR and MoCA's scores based on educational level, the results yielded p-values= 0.409 and 0.1 for CR and MoCA, respectively. These values indicated that, at the 5 % significance level, there was insufficient statistical evidence to conclude that there were significant differences in CR and cognitive impairment scores between the educational level groups.

An assessment was performed to assess whether there was a significant difference in total CR test scores between bilingual and non-bilingual participants, the results revealed a significant difference between the two groups, with p-value= 0.005, this indicates that, at a significance level of 0.05, the mean CR scores of bilingual and non-bilingual participants differ. Additionally, it was seen the mean score for the non-bilingual group was significantly lower than that for the bilingual group (p= 0.002). The assessment yielded a chi-squared value= 2.534 and a p-value= 0.111, indicating that there is no statistically significant association between CR and cognitive impairment among this community's participants.

Discussion

Regarding sex, this research did not find a statistically significant relationship between sex and the development of neurodegenerative pathology. However, contrary to this result, the Pan American Health Organization has reported that most people affected by dementia are women [11]. Other researchers [12] found that women had a longer life expectancy than men, as well as greater comorbidity and higher levels of disability. Women were significantly affected by symptoms of the pathology, and they had less access to health services due to their role as family caregivers. This matched the results reported by a researcher [13], who indicated that dementia predominantly affected women. In this regard, it has been shown that women's reproductive factors are associated with an increased risk of dementia; however, data are inconclusive [14].

During the menopausal transition, cognitive deficits in working memory and attention, reduced processing speed and impaired verbal memory have been reported in women, which would increase their natural risk of developing dementia. Our results could be related to the everyday activities of the women of San Jeronimo Yahuiche, such as creating handicrafts from black clay, weaving palm leaves, weaving on a loom, gardening and preparing food. It has been speculated that these activities could contribute to the development of cognitive reserve, but there is currently no scientific evidence to support this.

When analyzing cognitive reserve, no representative data were found to establish a relationship between CR and sex. This is in contrast to the findings of several authors [15], who found that cognitive impairment was more prevalent in older women, who had lower cognitive reserves and progressed rapidly to advanced dementia. Conversely, men had greater brain volume and cognitive reserve, and a lower degree of dementia severity [11]. As discussed above, women perform activities that may generate cognitive reserve, although these have not yet been scientifically recorded.

Arterial hypertension and diabetes mellitus are common pathologies during ageing [14]. According to one study [16], chronic degenerative diseases act as risk factors that largely determine the progression of dementia in individuals. The study showed that older people with cognitive impairment, a history of hypertension, diabetes mellitus and dyslipidaemia progress to dementia at a higher rate [16]. Other investigators [17] reported that, while the mechanism by which these diseases increase the risk of cognitive impairment or dementia remains unclear, a strong correlation between the two has been identified. Several other investigators [18,19] have noted that systemic arterial hypertension could influence the development of diseases associated with cognitive decline, such as cognitive impairment and dementia.

The results show that, in the studied population, diabetes mellitus was clearly associated with cognitive impairment (but not hypertension), thus confirming the findings of previous studies [20]. It was also determined that the prevalence of chronic non-communicable diseases such as diabetes mellitus and dementia were related to age, occurring more frequently in old age [20, 21].

People with diabetes mellitus are at an increased risk of neurocognitive impairment due to the neurological damage caused by advanced glycation end products (AGEs) and their receptors. Therefore, dementia may be associated with brain insulin resistance resulting from the misregulation of the insulin-degrading enzyme and the accumulation of beta-amyloid protein [20]. Similarly, evidence suggests that diabetes mellitus is a risk factor for Alzheimer's disease [22].

Few studies have investigated the association between rheumatoid arthritis and cognitive impairment. It has been suggested that there is an increased prevalence of cognitive impairment in older adult patients with this disease [19], although the exact process by which it develops is currently unknown. Neuroinflammation is believed to be the main cause. It is thought that decreased blood supply in the presence of chronic inflammation limits adequate blood flow to the brain [23]. Conversely, the reduced risk of dementia may be due to the anti-inflammatory properties

of drugs administered to patients with rheumatoid arthritis [24]. However, the results of this study did not reveal a significant association. It should be noted that neither the progression of the disease nor the pharmacological treatment received were investigated; these factors could have influenced the results.

Disabilities are a disabling phenomenon that diminishes the quality of life of older people and leads to an increased prevalence of associated pathologies, particularly if visual and hearing impairments are prevalent [25]. According to the National Institute for the Blind, visual impairment in older people is a consequence of age-related diseases, an unhealthy lifestyle, and ageing itself. Some authors suggest that visual impairment may increase the risk of developing dementia by allocating cognitive resources to cope with the additional demands of older people [26].

People with hearing impairment are more likely to develop dementia and other neurological problems [25]. A study [27] of older adults with hearing impairment observed an increased risk of cognitive impairment and dementia in the future. This research demonstrated an association between pathology and the potential development of cognitive problems. Although there is evidence of a relationship between visual and hearing impairments and cognitive impairment, no statistically significant association was found in this study. This may be due to the small number of cases involving these disabilities, and the lack of medical confirmation of their presence or absence.

Scientific evidence shows that a higher level of education throughout life makes individuals more resilient to pathological brain processes that may arise in old age. A low level of education has been shown to increase the risk of developing diseases that lead to cognitive decline in older adults [28]. Higher levels of education are generally associated with better brain performance and, consequently, intellectual well-being. This plays an important protective role in cognitive health in old age [29].

Constant stimulation of neuronal networks in the brain resulting from education causes the generation of CR in individuals. This acts as a factor that delays and reduces the symptoms of cognitive dysfunction in the presence of brain pathologies [28]. Literature was found on the correlation between high levels of schooling and high cognitive reserve, and how this influences cortical thickening to delay specific symptoms of cognitive decline [30]. Higher levels of CR imply the use of cognitive strategies and resources to achieve more efficient brain performance. Therefore, using two languages daily activates the brain's structures and functionality in response to environmental needs [31]. Contrary to these claims, this study found no association between educational level, cognitive impairment, and cognitive reserve. Despite the participants' low educational levels, the results did not show high cognitive impairment or low cognitive reserve. This could be due to the population's own activities (cultural, economic, gastronomic, etc.) generating CR despite the low education level.

Bilingualism is considered to promote cognitive reserve, acting as a protective factor in the prevention of dementia. It is also notable for delaying the onset of symptoms in the elderly [31]. In Oaxaca's population, older adults speak their mother tongue and Spanish, meaning they are considered bilingual. The results obtained confirm that there is a close relationship between bilingualism and the development of cognitive impairment. It is possible that mastering two languages compensates for the population's low educational level.

In answer to the research question, while some authors [32,33] have noted evidence supporting the role of CR in preventing the deterioration of neurocognitive functions in old age, this study found no association between CR and cognitive decline.

It is important to note that the instrument used to assess CR in this study does not take into account community-specific activities which may contribute to cognitive reserve, but which have not yet been the subject of study. Instead, the focus is on activities that differ from those performed by this

community, such as booking hotels, starting the washing machine, answering the telephone, taking courses or workshops, reading newspapers or books, surfing the Internet, writing poetry, going hiking or to the theatre or cinema, and so on.

One limitation of this research was the size of the sample. Although it was representative of the population studied, it comprised a small number of participants. Therefore, it is necessary to conduct further research with larger populations in this age group. Another limitation was the lack of Mexican instruments to assess cognitive reserve. Consequently, a Spanish instrument was used, which, despite being validated and not differing in language, did not take into account the daily activities performed by the population included in this study. It is therefore recommended that a new instrument be created to accurately identify the CR of the Mexican population based on their daily activities.

Conclusions

The results show that the majority of participants were female, older, and had a low level of education, factors which may significantly influence their cognitive performance and how they cope with ageing. Additionally, the high proportion of married individuals and indigenous language speakers underscores the necessity of considering sociocultural and contextual factors when evaluating the cognitive status of older adults. These results emphasize the importance of designing culturally relevant interventions that are adapted to the demographic profile of the population.

Furthermore, it was concluded that no significant association was found between CR and cognitive impairment. However, the results suggest that diabetes mellitus could be related to the development of cognitive impairment in this population. Additionally, it was observed that higher age was associated with lower scores on the MoCA test, which could indicate a tendency towards cognitive

impairment associated with ageing. Finally, the findings also suggest that bilingualism could act as a protective and stimulating factor for cognitive reserve.

Scientific evidence suggests that people living in rural communities such as San Jerónimo Yahuiche experience less cognitive stimulation due to a lack of activities that promote cognitive reserve. However, despite this lack of stimulation, these individuals are found to be within the normal range in terms of cognitive ability. This highlights the need to explore other potential contributors to CR that have not yet been scientifically investigated, such as preparing complex traditional dishes like mole, participating in cultural dances from a young age, and making and selling handicrafts, among other possibilities. Once these activities have been identified and characterized, it will be possible to develop an appropriate assessment tool for this population, allowing for a more precise evaluation of cognitive reserve.

This type of research should not be limited to developed countries or urban areas with favorable living conditions, such as access to education and healthcare, a medium-to-high standard of living and leisure activities. The ageing process is not exclusive to these environments, and characterizing specific populations in these areas does not adequately address the challenge of population ageing. Furthermore, it does not facilitate the development of public policies to address this health problem. The state of Oaxaca is distinguished by its cultural richness, which is naturally possessed by the elderly. Despite not having received a high level of education themselves, they have passed this richness on from generation to generation. It is common to see older people in Oaxaca who are still active members of the workforce. According to the scientific literature, they do not possess the necessary protective factors to develop cognitive impairment. This raises the question: what activities or circumstances generate their cognitive reserve? This question prompts deep reflection on the activities and life experiences of this population and could lead to new areas of research aimed at improving our understanding of CR in different contexts.

This research highlights the need to conduct research in specific cultural contexts in order to develop culturally appropriate tools. This will enable health interventions to be tailored for the benefit of communities that are often marginalized.

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The authors stated that they have not used any artificial intelligence resources in any of the sections of this manuscript.

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