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Prevalence of cognitive impairment in Brazilian indigenous community from Amazonas

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ABSTRACT. Studies on the prevalence of dementia in the indigenous population are still scarce worldwide. In the few available studies, prevalence evidence varies from low to very high, with early onset of the disease and high mortality rate after the initial diagnosis. Still, little is known about the rate of dementia in indigenous populations from low- and middle-income countries, where the dementia prevalence in the general population is estimated to increase significantly in the next decades. **Objective:** This study aimed to determine the prevalence of cognitive impairment and associated factors in Brazilian indigenous people of the Mura ethnicity in Amazonas, Brazil. **Methods:** A total of 217 indigenous individuals aged 50 years and older from Amazonas, Brazil, were submitted to cognitive assessment. Attention, memory, verbal fluency, visuospatial performance, and mood state composed the cognitive impairment diagnosis. **Results:** The prevalence of cognitive impairment was 43.3% (95%CI 36.6–49.7) and varied according to age [OR=1.03 (95%CI 1.00–1.06)], education [OR=0.74 (95%CI 0.62–0.87)], body mass index [OR=0.91 (95%CI 0.83–0.98)], and income [OR=0.52 (95%CI 0.27–0.99)]. **Conclusions:** Cognitive impairment had an early onset in an indigenous community, and its prevalence was greater in older individuals with low education and low family income. These findings highlight the importance of implementing public indigenous health policies focusing on health professional training for early cognitive impairment detection.

Keywords: Cognitive Dysfunction; Dementia; Population Groups; Epidemiology; Prevalence.

PREVALÊNCIA DE COMPROMETIMENTO COGNITIVO EM INDÍGENAS BRASILEIROS DO AMAZONAS

RESUMO. No mundo, estudos sobre a prevalência de demência em idosos indígenas são insuficientes, porém nas evidências disponíveis, a prevalência varia de baixa a muito alta, com início precoce da doença e elevada taxa de mortalidade após o diagnóstico inicial. As evidências em países de baixa e média renda são escassas, e neles a prevalência de demência aumentará significativamente nas próximas décadas. **Objetivo:** Determinar a prevalência de déficit cognitivo e fatores associados em indígenas brasileiros da etnia Mura no Amazonas, Brasil. **Métodos:** Duzentos e dezessete indígenas com 50 anos ou mais do Amazonas, Brasil, foram submetidos a avaliação cognitiva. Atenção, memória, fluência verbal, desempenho visuoespacial e estado de humor compuseram o diagnóstico de déficit cognitivo. **Resultados:** A prevalência de déficit cognitivo foi de 43,3% (intervalo de confiança — IC95% 36,6–49,7) e variou de acordo com a idade [*odds ratio* — OR=1,03 (IC95% 1,00–1,06)], educação [OR=0,74 (IC95% 0,62–0,87)], índice de massa corporal [OR=0,91 (IC95% 0,83–0,98)] e renda [OR=0,52 (IC95% 0,27–0,99)]. **Conclusões:** O comprometimento cognitivo teve início precoce na comunidade indígena, sendo sua prevalência maior em idosos com baixa escolaridade e baixa renda familiar. Esses achados destacam a importância da implementação de políticas públicas de saúde indígena, com foco na formação de profissionais de saúde, para a detecção precoce do déficit cognitivo.

Palavras-chave: Disfunção Cognitiva; Demência; Grupos Populacionais; Epidemiologia; Prevalência.

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INTRODUCTION

Almost 70% of the 130 million people expected to develop dementia by 2050 are living in low- and middle-income countries[1]. The global estimated prevalence of dementia is 5–7%, with higher rates in low- and middle-income countries and illiterate older adults[2,3]. The prevalence of cognitive impairment no dementia (CIND) varies widely, ranging from 3 to 27%[4-7], and in Brazil, it ranges from 19.5 to 34.8% [8,9]. Unlike dementia, in mild cognitive impairment (MCI) and CIND, the patient can keep independence in functional abilities[10]. MCI clinical diagnosis is based on evidence of cognitive decline reported by patient or informant or clinician over time, objective evidence of impairment in one or more cognitive domains, preservation of independence in functional abilities, and not demented[10,11]. The concept of CIND is a broader definition of impairment that encompasses subjects who meet criteria for MCI and others who are cognitively impaired but do not meet all the criteria for MCI[11].

These projections may be underestimated when considering minority groups, such as indigenous population, who are disproportionately impacted by diseases worldwide[12,13]. Despite recent efforts to increase the inclusion of minority groups, indigenous populations are still underrepresented in dementia research, posing a challenge to understand the real impact of dementia across all race, ethnic, and social groups[12,13].

Indigenous populations are growing rapidly, and approximately 370 million individuals are estimated to be worldwide[14]. The advancement of urbanization, changes in dietary habits, and the aging of indigenous population have contributed to increase the prevalence of hypertension, diabetes mellitus (DM), obesity, metabolic syndrome, and alcoholism[15-17]. These conditions represent important risk factor for atherosclerosis, which plays a pivotal role in the etiology of cognitive impairment and dementia[18].

Despite that, the evidence regarding dementia in that population is scarce[19,20]. A recent systematic review revealed that dementia prevalence in the indigenous population range from 0.5 to 26.8% in individuals from high-income countries[21]. Early onset and high mortality represent the main features of dementia in indigenous[21]. Moreover, age, low educational level, and poor health conditions are the major modifiable risk factors reported[21].

Poverty, low educational levels, limited access to health system resources, and lack of population understanding about dementia pose additional vulnerability to cognitive disorders in the indigenous population from low- and middle-income countries[22]. However, fundamental questions remain regarding the dementia prevalence in those individuals, arising the critical need to understand how dementia affects indigenous communities in low- and middle-income countries[3]. The absence of such knowledge limits health policy maker actions and compromises the implementation of preventive measures to reduce the global disparities in dementia. The aim of this study was to determine the prevalence of cognitive impairment and associated factors in a Brazilian indigenous people of the Mura ethnicity in Amazonas, Brazil.

METHODS

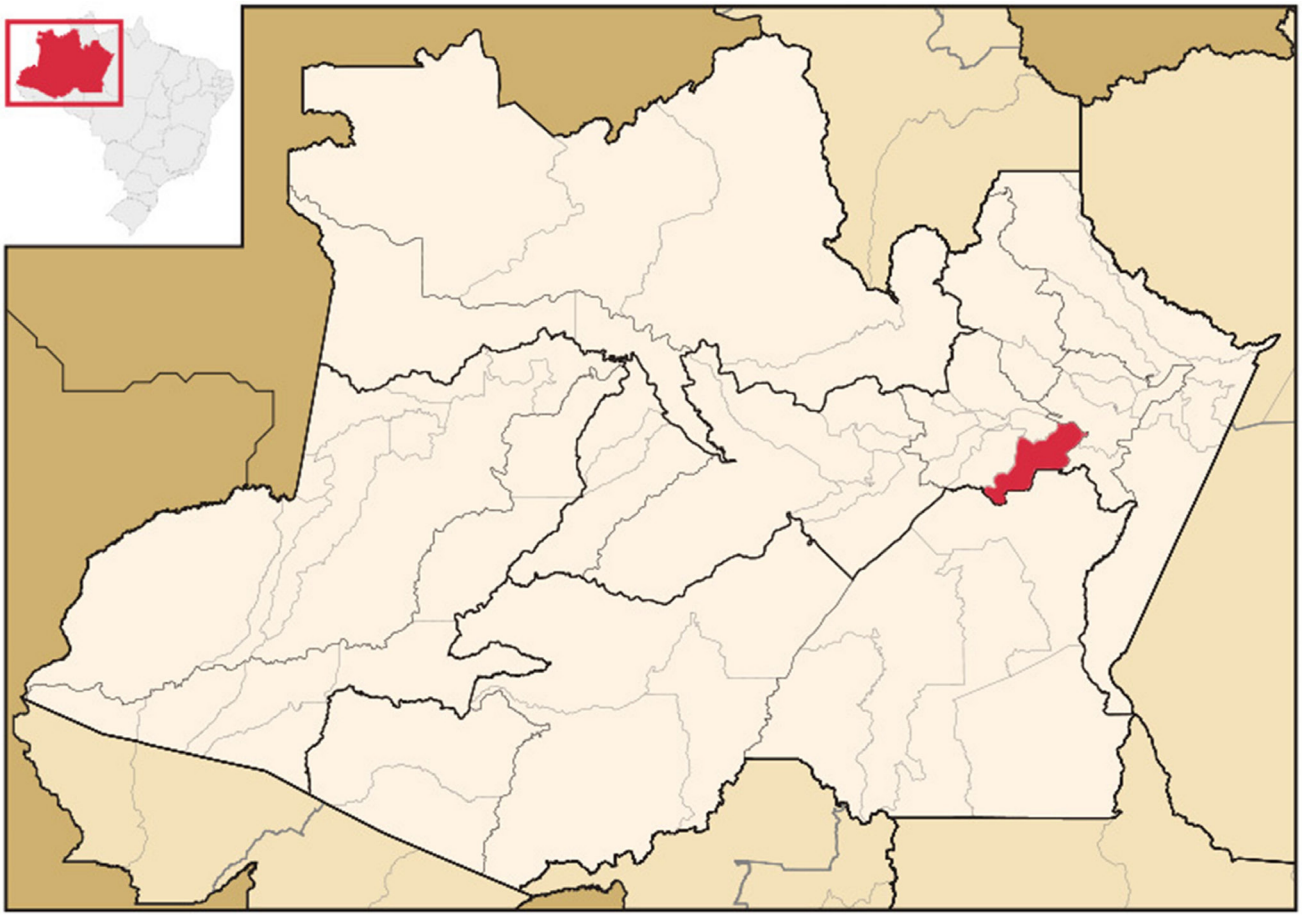
Study design and setting

A cross-sectional observational study was carried out in the village of Pantaleão, which is 218 km from Manaus, located in Amazonas, Northern Brazil (Figure 1). Autazes inhabitants are distributed among three ethnic groups: the Apurinã, Munduruku, and Mura. In the last census in 2013, Mura represented the most populous ethnicity, with 8,103 indigenous people and 12.8% of older adults[23].

After authorization from the National Foundation of Indians (FUNAI), the official Brazilian organization for indigenous population, a survey was conducted with those inhabitants aged ≥50 years with the assistance of local organizations, members of the community, and health care workers. Given the absence of reliable data on the number of dwellers aged ≥50 years, the snowball (referral) sampling technique was employed, whereby participants and other members of the community helped identify potential participants known to them to increase the sample size. A total of 245 indigenous individuals were identified. Data collection was carried out in a single phase, entailing an interview conducted at the household by a nurse trained in applying the tests. Testing took, on average, 70 min and included informed consent, the sociodemographic questioner, anthropometric data, cognitive and mood assessment, and subjective cognitive decline. The Research Ethics Committee of the School of Nursing of the University of São Paulo (nº 1.105.424), the National Research Ethics Committee, and the FUNAI (CONEP, nº 1.308.120) approved the study.

Participants

The study included individuals who self-identified as indigenous, lived, or worked in the village of Pantaleão and spoke Portuguese besides the native language. Dwellers out of town or who had deceased during the data



Source: SIASI/SESAI/MS (2013).

Figure 1. Geographical location of the municipality of Autazes in Manaus, Amazonas. SIASI/SESAI/MS (2013).

collection period were excluded, as they were individuals who refused to participate. None of the participants showed visual or hearing deficits precluding cognitive assessment, psychoactive medication, and had a history of stroke in the past 3 months. The final sample comprised 217 indigenous subjects of both genders (n=126 women; 58.1%), with a mean age of 64.2 (range 50–100) years.

Cognitive assessment

All participants were submitted to the following neuropsychological tests: the Mini-Mental State Examination (MMSE) recommended for use in Brazil[24]; the Brief Cognitive Screening Battery (BCSB) involving immediate and delayed recall (after 5 min), often printed drawings (e.g., shoe, house, comb, plane, turtle, book, spoon, tree, and bucket) scoring 10 points each[25]; the Digit Span Forward (DSF) and Digit Span Backward (DSB) entail the repetition of six sequences, each containing two and seven digits, to be repeated by the participant in the order readout (DSF) and reverse order (DSB), scoring 6 points in maximum; the Semantic Verbal Fluency Test (Animals and Fruits)[26]; and the Stick Design Test[27], which involves reproducing four different drawings (i.e., square, a triangle with a shaft, rafters, and rake) shown previously, using four matchsticks. All of these tests have been validated for use in the Brazilian population and possess discriminatory sensitivity for identifying cognitive impairment in individuals with low educational level[24-28].

Subjective cognitive decline

The memory complaint scale comprises seven questions assessing the frequency of memory complaints and the degree they impact daily activities. Responses are graded in increasing intensity (0, 1, and 2), yielding the following classification: no memory complaints (0–2 points), mild memory complaints (3–6 points), moderate memory complaints (7–10 points), and severe memory complaints (11–14 points)[29].

Mood and depressive symptoms

The mood was measured by the Faces Scale of Andrews[30], a visual scale containing seven figures of stylized faces

representing expressions ranging from extreme happiness to extreme unhappiness, with 1: very happy; 2: happy; 3: somewhat happy; 4: regular; 5: somewhat unhappy; 6: unhappy; and 7: very unhappy. The lower the rating, the greater the degree of psychological well-being, where score ≥4 indicates impaired well-being. Depressive symptoms were assessed using the short version of the Geriatric Depression Scale (GDS), comprising 15 questions (yes/no) on depression symptoms. A score ≥6 indicates a positive screen for depression and requires further examination[31].

Criteria for cognitive impairment diagnosis

Cognitive assessment, subjective cognitive decline, and mood data were independently reviewed by two neurologists to reach a consensus diagnosis, based on the criteria established by the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and International Classification of Diseases (ICD-10) for dementia diagnosis[32]. The consensus diagnosis was used to classify participants into "with cognitive impairment" and "without cognitive impairment." This classification was based on the following criteria:

1. Score on MMSE ≤14 for illiterate subjects and ≤19 for literate subjects (mean minus two standard deviations based on the normative data)[33];
2. Score ≤9 on verbal fluency or ≤7 on delayed recall of BCSB[24-28,33];
3. Analysis of performance on the other cognitive tests, according to case-by-case observation; and
4. The instruments assessing subjective cognitive decline, mood, and depression symptoms were also considered in the classification.

A third specialist reviewed disparities on the consensus diagnosis. Due to the unavailability of several participants' relatives, functional assessment for daily living activities of indigenous older adults was not determined, and therefore, discrimination between MCI and dementia was not performed.

Statistical analysis

Data were normally distributed. An analysis of variance (ANOVA) was used for repeated samples with Greenhouse correction in the absence of sphericity in the distribution pattern of the variables. Multiple comparisons (post-hoc) were made using the Bonferroni test. Student's t-test and chi-square test were used to compare means and frequencies, respectively. To characterize the sample, classic descriptive analysis procedures were used with average, standard deviation, and absolute and relative frequency calculations. The association between the prevalence of cognitive impairment and factors such as sex, age, education, income, arterial hypertension, DM, smoking, alcoholism, body mass index (BMI), and mood changes was analyzed using odds ratio (OR) measures. The significance level was 5% with a 95% confidence interval.

RESULTS

Description of sociodemographic, habits, and medical history

Participants were predominantly female, aged 50–100 years, self-identified indigenous, widowed or in a stable union, and had low educational level (0–15 years) and economic status. The majority of the population (92.7%) belong to low economic status (D and E classes), with a family income mean of R$ 639.78 (160–180 range in US$). Regarding medical history, most participants were not in the use of medications, had no chronic diseases, and were within the ideal limit for BMI. There was no significant difference between the groups for sociodemographic characteristics or medical history (Table 1).

Cognitive impairment and associated factors

The prevalence of cognitive impairment was 43.3% in the total sample. The odds of cognitive impairment varied across age, education, and BMI (Table 2). In participants aged ≥50 years, every year of age increased the odds of cognitive impairment by 3% (OR=1.03), whereas every year of education reduced the odds by 26% (OR=0.74). In participants aged ≥60 years and those aged ≥65 years, every year of age increased the odds of cognitive impairment by 9% (OR=1.09) and each year of education reduced this chance by 29% (OR=0.71; Table 2). Moreover, BMI and family income reduced the odds of cognitive impairment by 10% (OR=0.90) and 48%, respectively, in individuals aged ≥60 years (Table 2).

DISCUSSION

This study revealed that almost half of the indigenous people over 50 years of age had signs of cognitive impairment, indicating a relatively higher prevalence and earlier onset, compared to the rates found in other indigenous populations[21]. Age and education levels were the main factors associated with cognitive impairment.

It is noteworthy that prevalence encompassed individuals with MCI and dementia. They were not discriminated against in our study due to the difficulties of having the participants' proxy evaluating their functional ability for daily activities. Comparing our findings

Table 1. Sociodemographic characteristics and medical history for total sample and according to cognitive impairment.

Variables		Cognitive impairment			p
		Total sample n=217	Yes n=94	No n=123	
		Mean (±SD) or n (%)	Mean (±SD) or n (%)	Mean (±SD) or n (%)	
Age, years		64.2 (10.2)	65.0 (11.5)	63.7 (9.1)	0.384
Age group	50–59	81 (37.3)	38 (40.4)	43 (35.0)	0.524
	60–64	44 (20.3)	16 (17.0)	28 (22.8)	
	≥65	92 (42.4)	40 (42.6)	52 (42.2)	
Education		1.3 (2.1)	1.1 (1.9)	1.5 (2.3)	0.164
Illiterate (% yes)		128 (59.0)	62 (66.0)	66 (53.7)	0.072
Gender (% female)		126 (58.1)	59 (46.8)	67 (53.2)	0.220
Indigenous (% yes)		216 (99.5)	94 (43.5)	122 (56.5)	0.567
Marital status	Single	14 (6.5)	6 (42.9)	8 (57.1)	0.062
	Married	63 (29.0)	22 (34.9)	41 (65.1)	
	Divorced	5 (2.3)	-	5 (100)	
	Others	135 (62.2)	66 (48.9)	69 (51.1)	
Retired (% yes)		116 (53.5)	52 (44.8)	64 (55.2)	0.631
Economic class	C2	6 (2.8)	3 (50)	3 (50)	0.525
	D-E	211(97.2)	91(43.1)	120(56.9)	
Medical history (% yes)	Medication	38 (17.5)	14 (36.8)	24 (63.2)	0.375
	Diabetes mellitus	43 (19.8)	17 (39.5)	26 (60.5)	0.576
	Hypertension	72 (33.2)	28 (38.9)	44 (61.1)	0.353
	Stroke	17 (7.8)	6 (35.3)	11 (64.7)	0.487
	Epilepsy	1 (0.5)	0 (0)	1 (100)	0.567
	Alcoholism	8 (3.7)	2 (25.0)	6 (75.0)	0.471
	Smoking	6 (2.8)	2 (33.3)	4 (66.7)	0.700
Body mass index	Underweight	6 (2.8)	2 (33.3)	4 (66.7)	0.732
	Normal	103 (47.5)	49 (47.6)	54 (52.4)	
	Overweight	80 (36.9)	32 (40.0)	48 (60.0)	
	Class I obesity	18 (8.3)	7 (38.9)	11 (61.1)	
	Class II obesity	7 (3.2)	2 (28.6)	5 (71.4)	

SD: standard deviation.

with previous studies in indigenous older adults[34-36], the prevalence detected was higher in the Mura indigenous participants. Smith et al.[36] found a prevalence of cognitive impairment of 40.2% (26.8% with dementia and 13.4% with CIND) in older adults aged 65 years and over. Radford et al.[35] found a prevalence of cognitive impairment of 38.7% (21.0% with dementia and 17.7% with CIND) among individuals aged 60 years and above, while Giudice et al.[34] reported a prevalence of 35.3% (21.0% with dementia and 14.3% with CIND) in older adults aged ≥45 years. In contrast, other authors have found a low prevalence (0.4–7.5%) in indigenous

Table 2. Prevalence of cognitive impairment and associated factors.

Yes	Prevalence of cognitive impairment					
	Total sample n (%) [95%CI]		≥60 years n (%) [95%CI]		≥65 years n (%) [95%CI]	
	94 (43.3) [36.6–49.72]		59 (43.7) [35.63–52.13]		47 (51.1) [41.04–61.05]	
Associated factors	[95%CI]	OR	[95%CI]	OR	[95%CI]	OR
Sex (female)	0.86–2.6	1.5	0.86–3.40	1.71	0.96–5.08	2.20
Diabetes mellitus	0.81–3.14	1.6	0.59–2.84	1.29	0.46–3.14	1.20
Hypertension	0.52–1.63	0.92	0.39–1.60	0.79	0.30–1.64	0.71
Alcoholism	0.02–1.49	0.18	0.01–2.25	0.12	0.01–5.21	0.23
Smoking	0.26–6.76	1.33	0.08–21.11	1.29	0.06–15.77	0.96
Age	1.00–1.06*	1.03	1.04–1.15*	1.09	1.02–1.18*	1.09
Education	0.62–0.87*	0.74	0.53–0.91*	0.71	0.49–0.94*	0.71
Income	0.42–1.05	0.67	0.27–0.99*	0.52	0.27–1.27	0.59
Body mass index	0.83–0.96*	0.90	0.83–0.98*	0.91	0.84–1.03	0.93
Mood	0.81–3.14	1.60	0.86–3.40	1.71	0.96–5.08	2.20

OR: odds ratio; CI: confidence interval; *significant association.

populations from Canada, Australia, and Guam[37-41]. However, these studies involved older adults with greater education[6,8,36] or diagnosed according to clinical criteria[37-41] without citing the use of neuropsychological tests, in contrast to this study.

Regarding associated factors, the odds of cognitive impairment were higher in older participants, proving up to three times higher in older adults over 65 years than in younger participants. Moreover, approximately 58% of the participants with cognitive impairment were <65 years old. Among them, 40.4% were aged 50–59 years, suggesting earlier cognitive impairment onset than the general population, which is approximately 70 years old for MCI in the United States and over 60 years old in Brazil[42]. A recent systematic review corroborates our findings reporting that age was the main non-modifiable risk factor for cognitive impairment in the indigenous population[21]. Furthermore, CIND and dementia were detected in indigenous individuals aged 45–65 years[34-36,38,40], supporting that early cognitive impairment occurs in the indigenous population.

Education was another factor found to influence the prevalence of cognitive impairment in the indigenous population of the village of Pantaleão. For participants aged 50 years and over, each year of schooling decreases cognitive impairment by 26%. Moreover, the rate of cognitive impairment tended to be higher among illiterate than educated individuals. Low education has been reported as one of the main risk factors for dementia, particularly in developing countries, including those in Latin America and Brazil[2,3]. Older adults with 8 years of education or less are approximately twice as likely to develop dementia than higher educated individuals[2].

The current explanation for the low education impact on increasing the risk of dementia is grounded in the cognitive reserve theoretical model[43,44]. According to this model, some people can better tolerate the brain structural and biochemical changes by recruiting compensatory or preexisting brain mechanisms intrinsically related to educational and occupational activities[43,44]. Individuals with low levels of education tend to use the brain for processing differently than individuals with high levels of education[43,44]. Inter-individual variability, efficiency, and flexibility in the primary brain networks invoked in a task performance are the theoretical model explaining differences of cognitive performance in individuals with low education and from diverse ethnic groups[43,44]. Smaller cognitive reserve, low schooling, and temporary exposure to a health demand anticipate, in years, a

clinical manifestation of dementia[45]. In this sense, the high prevalence of cognitive impairment observed in mid-life and older adults indigenous may be related to low cognitive reserve due to illiteracy and low educational level. However, the educational level is not the only or even the best cognitive reserve indicator in any population[43,44], especially in those from diverse ethnic backgrounds. The influence of culture and environment on neural activity, cognitive network, and cognitive reserve's neural basis is still a topic of ongoing research[43,44]. Therefore, future studies investigating clinical and biological indicators of cognitive reserve are necessary to elucidate the factors associated with the high prevalence of cognitive impairment in indigenous populations.

BMI and family income also affected the odds of cognitive impairment in the indigenous participants. Cognitive impairment odds were reduced by 10% for every point on the BMI, while each family income unit reduced the odds of cognitive impairment by 48% in older adults aged ≥60 years. Corroborating this finding, Giudice et al.[34] observed that low BMI was associated with greater cognitive decline in Aboriginals over a follow-up period of 5 years. Some participants presented lower-than-expected BMI in this study, which may have influenced the cognitive impairment odds. Regarding income influence, the lower the socioeconomic level, the higher the dementia prevalence in non-indigenous older adults in a Brazilian study[19]. Many authors hold that, in indigenous communities, the poor living conditions, low family income, poor housing, and limited access to health services represent important factors contributing to the cognitive impairment risk[43]. Although other indicators assessing socioeconomic level were not objectively assessed, the poor living conditions of the dwellers of Pantaleão were evident during the interviews, most of which were conducted at participants' homes. The majority of houses were wooden, arranged in streets and plots, many backing onto streams. A water supply system existed, but well water was predominantly used and basic sanitation deficient. Many homes housed multiple families, where this overcrowding exacerbated disorganization and poor hygiene. Most dwellers were unemployed, living on government welfare (pension or benefits).

In contrast to previous studies, no association between chronic noncommunicable diseases (NCDs) and the cognitive impairment prevalence rates was observed[15,17,19]. High rates of hypertension, DM, and dyslipidemia have been described in indigenous populations, with and without cognitive impairment[15,17,19]. Therefore, low percentages of diabetes, hypertension, and obesity observed in the current sample may explain the lack of association[15,17,19].

Limitations and final considerations

First, the sample comprised indigenous from a single village in the State of Amazonas. Further evidence from other ethnicities and rural communities can complement the current findings. Additionally, longitudinal studies with systematic participants follow-up, based on regular cognitive and clinical assessments, including the evaluation of dementia diagnosis, dementia biomarkers, such as tau protein and beta-amyloid, can discriminate cases into CIND and dementia, as well as enable identification of reversible dementia cases and factors that increase the risk of developing dementia in the indigenous population.

The use of traditional neuropsychological tests may also be a limitation. The cognitive tests applied in this study were already used by participants from Mamirauá and Amanã Sustainable Development Reserves, located about 600 km west of Manaus (Amazonas) in the Brazilian Amazonian region[33]. Moreover, they were featured by visual tasks and present low educational level influence. However, those tests were not validated for cognitive impairment diagnosis in the indigenous population. In interpreting our findings, a lack of adapted tests for the indigenous culture should be considered. Finally, functional assessment should be employed in future studies to better discriminate those with CIND from those with dementia.

Despite the limitations, the current evidence contributes to understanding the health disparities in low- and middle-income countries by providing evidence about cognitive impairment in Mura indigenous population in Brazil and the related factors.

An indigenous community from Amazonas, Brazil, presented high cognitive impairment prevalence, featured by early onset and associated with age, low educational level, BMI, and income. By showing the indigenous vulnerability to cognitive disorders, the current findings highlight the critical need to expand the investigation of dementia in underrepresented populations to adequately plan global strategies to face the dementia burden worldwide.

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Authors' contributions

APC: conceptualization, investigation, methodology, resources, writing – original draft. SMDB: data curation, formal analysis, methodology, supervision, writing – review & editing. RN: data curation, formal analysis, methodology, supervision, writing – review & editing. CCB: data curation, formal analysis, methodology, resources, writing – review & editing. FCS: data curation, formal analysis, methodology, resources, writing – review & editing. JNST: conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, supervision, writing – original draft, writing-original draft.

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