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Original Paper

Prevalence of Cognitive Impairment Amongst Older Adults and the Associated Risk Factors

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Abstract: Cognitive impairment in older adults refers to a decline in mental abilities such as memory, attention, and problem-solving, often associated with aging. This study aimed to show the prevalence of cognitive impairment among older people and examine the risk factors in acquiring the disease. This cross-sectional, community-based study was implemented between August 2022 and August 2023. The study population involved older adults (n= 400) living in urban regions aged ≥60 years. A questionnaire used to collect socio-demographic data. Further, mini mental state examination tool to assess cognitive function, activities of daily living tool to assess physical functional capacity, patient health questionnaire-9 tool to identify depressive symptoms, Snellen chart to examine visual acuity and whispered voice test to examine hearing acuity were used. Chi-square test used to investigate the association between risk factors and cognitive impairment. The prevalence of cognitive impairment was 31.25% in examined community. The risk of the disease was higher in the following participants: age group 90-100 (71.4%), female (45.9%), unemployed (47.1%), having insufficient socioeconomic level (51.2%), being illiterate (49.3%), having low hearing acuity (77.4%), having sever functional impairment (78.6%), being widowed (56.8%), living with others rather than a spouse (54.4%), having low visual acuity (33.3%), and having depressive symptoms (65.1%). The severity of cognitive impairment is statistically significantly related to age group of 90-100 years old (80%), smokers (n = 21) is mostly mild [n=9/21 (42.85%)], the decrease in hearing acuity is more frequent among those with sever cognitive impairment [n= 9/24 (37.5%)], and most of the features were of mild severity [n= 45/69 (65.2%)]. Cognitive impairment is a prevalent disease, and the risk factors are being females, unemployed, have a low socioeconomic level, illiterate, and widowed. Moreover, the disease is substantially related with increasing age, low hearing and visual acuity, depressive symptoms, and physical functional impairment.

1. Introduction

Cognition is the activity of the mind that involves all aspects of perceiving, thinking, and remembering, and it is often examined in research settings by a diverse variety of neuropsychological tests ranging from broad assessments to targeted evaluations of specific cognitive domains [1]. Mild cognitive impairment (CI) is the transitional phase between the normal cognitive decline associated with aging and the onset of dementia [2]. CI including its most severe form of dementia, is already a significant health concern for older adults and emerges as a global health crisis in the coming decades as a larger proportion of the population in both developed and developing nations have older ages population [3]. The worldwide prevalence of CI in older adults is 19% ranging from 5.1% to 41%. The

incidence of CI ranged from 22 to 76.8 per 1000 person-years, with a median value of 53.97 per 1000 person per years [4]. Cognitive decline is common after the age of 65 and typically progresses over year. Sever CI interferes daily living activities, such as feeding, grooming, or navigating familiar environments, which may ultimately progress to dementia [5]. Several modifiable risk factors of CI had been verified, such as low education, hypertension, hearing impairment, smoking, midlife obesity, depression, physical inactivity, diabetes, social isolation, excessive alcohol consumption, head injury, and air pollution [6]. It is important to acknowledge that the prevalence of CI can be reduced by addressing and altering these risk factors through public health interventions [7].

CI is routinely examined using screening measures such as the Mini-Mental State Examination (MMSE), the Montreal Cognitive Assessment (MoCA), and the Alzheimer's Disease Assessment Scale's cognitive subscale (ADAS-cog). The MMSE and MoCA tools are widely used in clinical practice [8]. The MMSE was developed by Folstein *et al.* [9] to differentiate between organic and functional psychiatric conditions. The standard MMSE form is still used today, with only minor modifications from the original. It is a valid and reliable tool for diagnosing and monitoring Alzheimer's disease (AD), requiring no special equipment or training to perform [10]. Despite some disadvantages, such as sensitivity to demographic factors such as age and education, and challenges with standardization across different languages, the MMSE remains widely used in clinical and research settings to assess CI and screening tool for dementia. Additionally, it helps estimate the severity and progression of CI and track an individual's cognitive changes over time [10]. The MMSE has achieved international standardization, is accepted by the neuroscientific community, and is recommended by the leading clinical practice guidelines for the assessment of CI, especially in older individuals [11]. It is important to note that the MMSE should never be regarded as a standalone assessment tool, but rather as a component of a comprehensive clinical evaluation [9].

Emerging data suggests that depression and CI are inseparably connected and that the two conditions can be triggered by one other. Previous studies reported that depression and CI were associated with functional disability [12]. The Patient Health Questionnaire depression module (PHQ-9) is a 9-item self-administered questionnaire designed to detect and assess depression severity [13]. Visual and auditory deficits are chronic disorders that can lead to cognitive decline and development of depression symptoms. Despite the fact that the prevalence of visual impairment increases with age, cataract surgery that improves vision is connected with improved cognitive performance and increased gray matter volume in the cortex. Similarly, hearing loss is more common in older persons. Study has reported that hearing loss increases the probability of CI which it is partially controllable and often left untreated [14]. The assessment of the physical domain is a crucial component in evaluating older individuals in both a clinical and research settings. Clinicians and researchers have conventionally used instruments that assess an individual's ability to perform certain functional tasks, such as the Activities of Daily Living (ADLs) or the Instrumental ADL scales, in order to evaluate physical function. The term ADLs was first coined by Sidney Katz in 1950 [15], and Instrumental Activities of Daily Livings (IADLs) were defined about ten years after, by a psychologist named M.P. Lawton [16]. ADLs are the fundamental self-care procedures necessary to meet one's physical needs, such as eating, dressing, and maintaining personal cleanliness. Lower levels of physical and cognitive performance are risk factors for developing challenges in ADLs and IADLs since both ADLs and IADLs need physical and cognitive functioning [17].

Although few papers had been published about geriatrics in Kurdistan Region of Iraq and to best of our knowledge, no previous study shed the light on CI in geriatric patients. Therefore, this study aimed to investigate the prevalence of CI among older people in the community and find the associated risk factors in acquiring CI.

2. Materials and Methods

2.1. Study Design and population

This cross-sectional community-based study performed in Sulaimani governorate/Kurdistan region of Iraq including 15 districts. Nearly 2475000 citizens are living in this governorate and 6% of the

populations are old adults [18]. The study conducted between August 2022 and August 2023. The study population involved older adults living in urban areas, aged ≥60 years [19] in Sulaimani governorate and its 15 districts. Potential participants refused or discontinued to take part in the study were excluded. A stratified randomized sampling technique was employed to recruit the study participants. The study proposal approved by the ethical committee of the College of Health and Medical Technology at Sulaimani Polytechnic University (ethical approval number: CH00037 on 18/12/2020) in accordance with International Ethical Guidelines for Epidemiological Studies, and the Declaration of Helsinki principle [20]. Further, informed consent obtained from all participants.

2.2. Sample Size Calculation

The sample size was calculated based on the total number of older adults (n=150 000) in Sulaimani governorate, a total of 400 old adults were selected using stratified random sampling. The sample size (n) is calculated according to the following formula:

$$n = [(z^2 * p * q) + ME^2] / [ME^2 + z^2 * p * q / N] \text{ [21]}$$

Where: z = 1.96 for a confidence level (α) of 95%, p = 0.5 proportion (expressed as a decimal), q = 0.5 (1-p), N = 150 000 population size, ME = 0.10 margin of error. n = [(1.962 * 0.5 * (1-0.5)) + 0.12] / [0.12 + 1.962 * 0.5 * (1-.05) /150 000] = 384 (400 older adults were recruited in this study).

2.3. Study Parameters

In this study, the CI was the dependent variable, while sociodemographic (age, sex, marital status, occupation, socioeconomic status, level of education, smoking, and social life), sensory (visual and auditory) impairment, depression, and physical functional capacity were the independent variables.

The study comprised a structured questionnaire to collect data about the sociodemographic characteristics of older adults as well as collecting health assessments of CI, sensory impairment, depression, and physical functional capacity. The data collection and health assessment were conducted through household survey. According to the WHO Age Friendly Primary Healthcare Centers 2008 toolkit [19], cognitive function was assessed with the MMSE tool which has a raw score range of 0 to 30 and its interpretation was: normal cognitive function with score of 25-30, mild cognitive impairment with score of 20-24, moderate cognitive impairment with score of 10-19, and severe impairment with score of less than 10 [19]. In this study, two sensory functions, vision and hearing, were assessed using the above WHO toolkit [19]. Visual acuity assessed with the aid of Snellen chart, in which the participant sat at a standard distance (40cm from the portable Snellen chart). Each eye tested separately by covering one of the eyes then participant was asked to read E letters on the chart. The lowest correct line is their distance visual acuity. Designated 6/6 is the smallest line that a person with normal acuity can read at the distance [22]. While the hearing check was assessed by Whispered Voice Test. The test was conducted by standing behind the person and ask to repeat three numbers (in normal voice) after the examiner. Repeating two or three numbers by the older person indicated normal hearing acuity, while no response, tell different number or repeat one number out of three numbers indicated abnormal hearing acuity [19].

Depressive symptoms were identified using PHQ-9 tool. Major depression disorder (MDD) is diagnosed when at least 5 of the 9 depressive symptoms are present for "more than half the days" in the past two weeks, with one of the symptoms being either a depressed mood or anhedonia [23]. The study applied a test known as the Katz Index of ADLs to assess the physical functional capacity and the participants were then categorized into three groups based on their level of physical impairment: severe functional impairment, moderate functional impairment, and full function [24]. The participants were rated as either fully independent or full function (no supervision, direction, or personal assistance needed) or dependent (needing supervision, direction, personal assistance, or total care) across the six skills, with a maximum score of six points indicating full function four points moderately impaired, and two points severely impaired [25].

In this study, the CI was the dependent variable, while sociodemographic (age, sex, marital status, occupation, socioeconomic status, level of education, smoking, and social life), sensory (visual and auditory) impairment, depression, and physical functional capacity were the independent variables.

2.4. Statistical Analysis

After collecting data from the participants, completed questionnaires were reviewed for inconsistencies and then the data tabulated using Microsoft Excel. The prevalence of CI calculated, and Chi-square test used to find the association between the examined risk factors and CI. A p value of ≤0.05 was considered significant for statistical analysis. Data analysis was conducted using the statistical software package IBMSPSS (Statistical Package for the Social Sciences version 23.0, Chicago IL, USA).

3. Results

3.1. Socio-demographic Characteristics

In this study, a total of 400 participants were involved and 60.2% were males. The participants ranged in age from 60 to 97 years old, with a mean age of 69.65 ±7.74 years old. The highest percentage (54.75%) of study participants was in age group 60-69 years. Additionally, the results revealed that 69% were married, 52.3% were illiterates, 52% were unemployed, 79.5% were in the barely sufficient socioeconomic class, and 84.5% were non-smokers. Regarding the social life of the participants, 64% were living with spouse, 25.75% living with others rather than spouses, and 10.25% were living alone (Table 1).

The visual acuity impairment was present in 360 out of 400 study participants (90.0%). Moreover, hearing difficulties was found in 31 of study participants (7.75%). The ADL examination revealed that 83.5% of older adults had full physical function, whereas 9.5% and 7% had moderate and severe functional impairments, respectively. The results of the PHQ-9 tool for assessing the MDD among the participants revealed that 86 subjects (21.5%) had features of MDD (Table 1).

Table 1: Sociodemographic and clinical characteristics of the study group.

Domains	Frequency	Percentage %
Age		
60-69	219	54.75
70-79	130	32.5
80-89	44	11
90-100	7	1.75
Gender		
Male	241	60.25
Female	159	39.75
Marital status		
Single	8	2.0
Married	276	69.0
Widowed	111	27.75
Separated	5	1.25
Occupation		
Retired	74	18.5
Employee	16	4.0
Unemployed	208	52
Laborer	102	25.5
Socioeconomic status		
Sufficient	41	10.25
Barely sufficient	318	79.5
Insufficient	41	10.25

Table 1: Continue

Level of literacy		
Illiterate	209	52.25
Read and write	52	13.0
Primary	75	18.75
Intermediate	26	6.5
Preparatory	19	4.75
Diploma academy	13	3.25
Bachelor degree	6	1.5
Social life		
Live with spouse	256	64
Live with others	103	25.75
Living alone	41	10.25
Smoking		
Yes	62	15.5
No	338	84.5
Visual acuity		
Normal	40	10
Abnormal	360	90
Hearing acuity		
Normal	369	92.25
Abnormal	31	7.75
Major depression disorder		
Yes	86	21.5
No	314	78.5
Physical functional capacity		
Full function	334	83.5
Moderate functional impairment	38	9.5
Sever functional impairment	28	7

3.2. Total MMSE Score

The MMSE mean score among all participants was 24.93 ±5.717 which is within the mild CI score. The results of MMSE score revealed that 68.75% (275 subjects) of older adults were within normal cognitive function, while 31.25% (125 subjects) were identified as having CI. The severity of CI was as follow: mild (15.5%), moderate (13.5%) and sever (2.25%) (Figure 1).

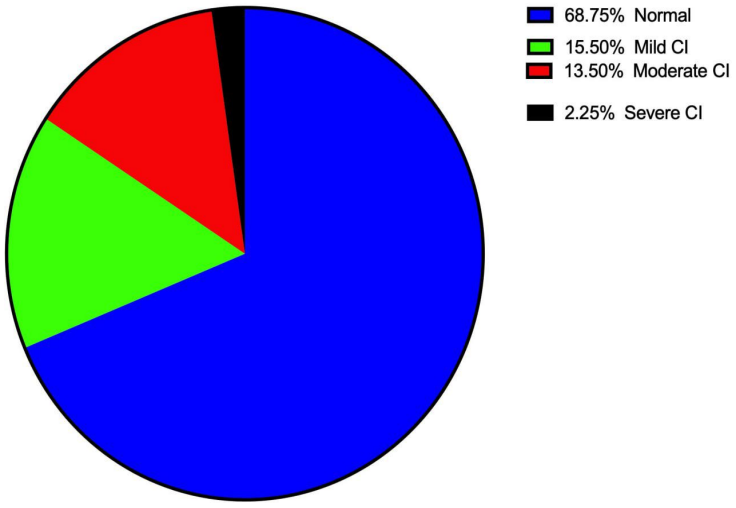

Figure 1: Distribution of the older adults according to their CI.

3.3. Factors Related with CI

The age, sex, marital status, occupation, level of literacy, socioeconomic status, social life, sensory function, ADL, and MDD were associated with CI at a p-value < 0.0 Whereas, smoking showed not statistically significant association. The findings revealed that the higher the age, the more statistically significant the association with CI, with older adults in the age group (90-100 years) having the highest percentage (71.4%) and older adults in the lowest age group (60-69 years) having the lowest percentage (17.8%). In addition, the results showed that CI was much more common in women than in men. Women had a 2.1 times higher risk of developing CI than men.

On the other hand, the results revealed highest percentages of CI in unemployed older adults (47.1%), widowed (56.8%), low socioeconomic status (51.2%), illiterates (49.3%), live with others rather than spouse (54.4%). Further, the clinical characteristics revealed that older adults with abnormal visual acuity were 2.7 times more likely than older adults with normal visual acuity to develop CI. Similar findings were also recorded for hearing acuity with 2.8 times higher in older adults with abnormal hearing acuity. In the current study, 65.1% of older persons with MDD showed CI, while only 22% of those without MDD had CI. Furthermore, CI was considerably higher in patients with severe (78.6%) and moderate (76.3%) physical functional impairments (Table 2).

Table 2: Factors related with CI among older individuals.

Domains	Normal cognitive function N=275 (%)	Cognitive impairment N=125 (%)	P value
Age			0.0001
60-69	180 (82.2)	39 (17.8)	
70-79	76 (58.5)	54 (41.5)	
80-89	17 (38.6)	27 (61.4)	
90-100	2 (28.6)	5 (71.4)	
Sex			0.0001
Male	189 (78.4)	52 (21.6)	
Female	86 (54.1)	73 (45.9)	
Marital status			0.0001
Single	5 (62.5)	3 (37.5)	
Married	218 (79)	58 (21)	
Widowed	48 (43.2)	63 (56.8)	
Separated	4 (80)	1 (20)	
Occupation			0.0001
Retired	61 (82.4)	13 (17.6)	
Employee	15 (93.8)	1 (6.3)	
Unemployed	110 (52.9)	98 (47.1)	
Laborer	89 (87.25)	13 (12.75)	
Socioeconomic status			0.014
Sufficient	29 (70.7)	12 (29.3)	
Barely sufficient	226 (71.1)	92 (28.9)	
Insufficient	20 (48.8)	21 (51.2)	
Level of literacy			0.0001
Illiterate	106 (50.7)	103 (49.3)	
Read and write	45 (86.5)	7 (13.5)	
Primary	65 (86.7)	10 (13.3)	
Intermediate	24 (92.3)	2 (7.7)	
Preparatory	18 (94.7)	1 (5.3)	
Diploma academy	11 (84.6)	2 (15.4)	
Bachelor's degree and higher	6 (100)	0 (0)	
Social life			0.0001
Live with spouse	203 (79.3)	53 (20.7)	
Live with others	47 (45.6)	56 (54.4)	
Living alone	25 (61)	16 (39)	

Table 2: Continue

Smoking			0.628
Yes	41 (66.1)	21 (33.9)	
No	234 (69.2)	104 (30.8)	
Visual acuity			0.006
Normal	35 (87.5)	5 (12.5)	
Abnormal	240 (66.7)	120 (33.3)	
Hearing acuity			0.0001
Normal	268 (72.6)	101 (27.4)	
Abnormal	7 (22.6)	24 (77.4)	
MDD			0.0001
Yes	30 (34.9)	56 (65.1)	
No	245 (78)	69 (22)	
Physical Functional Capacity			0.0001
Full function	260 (77.8)	74 (22.2)	
Moderate functional impairment	9 (23.7)	29 (76.3)	
Sever functional impairment	6 (21.4)	22 (78.6)	

* Significant difference between percentages using Pearson Chi-square test (χ 2 -test) at 0.05 level

3.4. Severity of CI and Associated Risk Factors

The different age groups were statistically significantly associated with the severity of CI (p value<0.05 as the highest frequency of CI was observed in the age group 70-79 years old (n=54/125), while the lowest one was in the age group 90-100 years old (only 5 out 125). The severity of CI was increasing with age; as mild CI was the most common (59%) among age group 60-69 years, while the majority in the age group 90-99 years old had sever CI (80%) (Table 3).

Majority of the participants (92.25%) had normal hearing acuity. Whereas in the CI group, the normal hearing acuity was reduced to 80.8%, however, the participants with abnormal hearing acuity were mostly having (77.4%) and the decrease in hearing acuity is more frequent among those with sever CI (37.5%) and the differences between the groups were statistically significant (p value<0.05). MDD was statistically significantly associated with age (p<0.05) as MDD more detected among older adults with CI (69 subjects out of 125), and among those with MDD most of the CI features were of mild severity (65.2%) (Table 3).

The majority of older adults with CI (104 subjects out of 125) were nonsmokers, and the severity of CI were mild (50.9%) and moderate (46.1%). While 21 smoker subjects have CI and the severity of CI were as follow: mild (42.8%), moderate (28.6%) and severe (28.6%). The comparison between smoker and nonsmoker groups were statistically significant (p value<0.05). Lastly, the all other variables including sex, marital status, occupation, socioeconomic status, level of education, social life, visual acuity, and physical functional capacity were not statistically significantly associated with the severity of CI (p>0.05) (Table 3).

Table 3: Association of study parameters with CI.

Parameters N (125)	Mild cognitive impairment frequency (%)	Moderate cognitive impairment frequency (%)	Sever cognitive impairment Frequency (%)	P value
Age				0.0001
60-69 (39)	23 (59)	14 (35.9)	2 (5.1)	
70-79 (54)	27 (50)	26 (48.1)	1 (1.9)	
80-89 (27)	11 (40.7)	14 (51.9)	2 (7.4)	
90-100 (5)	1 (20)	0 (0)	4 (80)	
Gender				0.0001
Male (52)	25 (48)	21 (40.4)	6 (11.5)	
Female (73)	37 (50.7)	33 (45.2)	3 (4.1)	

Table 3: Continue				
Marital status				0.0001
Single (3)	2 (66.7)	1 (33.3)	0 (0)	
Married (58)	31 (53.4)	23 (39.7)	4 (6.9)	
Widowed (63)	29 (46)	29 (46)	5 (8)	
Separated (1)	0 (0)	1 (100)	0 (0)	
Occupation				0.0001
Retired (13)	8 (61.5)	4 (30.8)	1 (7.7)	
Employee (1)	0 (0)	1 (100)	0 (0)	
Unemployed (98)	46 (47)	45 (45.9)	7 (7.1)	
Laborer (13)	8 (61.5)	4 (30.7)	1 (7.7)	
Socioeconomic status				0.03
Sufficient (12)	7 (58.3)	4 (33.3)	1 (8.3)	
Barely sufficient (92)	47 (51)	37 (40.2)	8 (8.7)	
Insufficient (21)	8 (38)	13 (61.9)	0 (0)	
Level of literacy				0.0001
Illiterate (103)	49 (47.6)	46 (44.7)	8 (7.7)	
Read and write (7)	5 (71.4)	2 (28.6)	0 (0)	
Primary (10)	5 (50)	5 (50)	0 (0)	
Intermediate (2)	1 (50)	1 (50)	0 (0)	
Preparatory (1)	1 (100)	0 (0)	0 (0)	
Diploma academy (2)	1 (50)	0 (0)	1 (50)	
Bachelor's degree and higher (0)	0 (0)	0 (0)	0 (0)	
Social life				0.0001
Live with spouse (53)	28 (52.8)	22 (41.5)	3 (5.7)	
Live with others (56)	28 (50)	24 (42.9)	4 (7.1)	
Living alone (16)	6 (37.5)	8 (50)	2 (12.5)	
Smoking				0.0001
Yes (21)	9 (42.8)	6 (28.6)	6 (28.6)	
No (104)	53 (50.9)	48 (46.1)	3 (2.9)	
Visual acuity				0.0001
Normal (5)	3 (60)	2 (40)	0 (0)	
Abnormal (120)	59 (49.1)	52 (43.3)	9 (7.5)	
Hearing acuity				0.0001
Normal (101)	55 (54.5)	46 (45.5)	0 (0)	
Abnormal (24)	7 (29.1)	8 (33.3)	9 (37.5)	
MDD				0.0001
Yes (56)	17 (30.4)	31 (55.4)	8 (14.2)	
No (69)	45 (65.2)	23 (33.3)		1 (1.4)
Physical Functional Capacity				0.0001
Full function (74)	45 (60.8)	28 (37.8)	1 (1.3)	
Moderate functional impairment (29)	10 (34.4)	18 (62)	1 (3.4)	
Sever functional impairment (22)	7 (31.8)	8 (36.4)	7 (31.8)	

* Significant difference between percentages using Pearson Chi-square test (χ 2 -test) at 0.05 level

4. Discussion

The investigation into the prevalence and associated risk factors of CI amongst older adults is driven by the increasing aging population globally and the substantial impact cognitive decline has on individuals, families, and healthcare systems. CI in older adults can lead to reduced quality of life, increased dependency, and higher healthcare costs. Understanding the prevalence and risk factors associated with cognitive impairment is crucial for developing effective prevention and intervention strategies. This study aims to provide comprehensive data on the prevalence of cognitive impairment

in Sulaimani Governorate in older adults and identify key risk factors such as age, education level, lifestyle choices, and comorbid health conditions. The study found a high prevalence of CI among older individuals. CI was more common in females, the unemployed, those with low socioeconomic status, illiterate individuals, and widowed subjects. It was strongly associated with increasing age, poor hearing and visual acuity, depressive symptoms, and physical functional impairment. The severity of CI was significantly related to age, hearing impairment, depressive symptoms, and smoking. In comparison to the sociodemographic characteristics of older persons living elsewhere, the findings are consistent with a recent study conducted in Iran with mean age was 70.1±7.3 years old. In addition, the older adults were most frequent in age group 60-69 years old in both studies. However, the older adults' prevalence among population in Sulaimani governorate was 6%, while in Tehran city/ Iran was 10.4%. It is important to highlight that the prevalence of older adults in the community is influenced by many factors including sex, genetics, availability of health care, hygienic status, nutrition, exercise, and lifestyle [25-26] Other sociodemographic results of the present study such as sex and smoking and alcoholic statuses were close to the study conducted in Iran. Whereas, higher proportion of older adults were illiterate (52.25% in current study versus 22.94% in the study conducted in Iran) and the middle socioeconomic status in the current study (79.5%) remarkably higher than the study conducted in Iran (36.7%) [27]. Of course, the difference in these sociodemographic factors play have been reported to be associated with CI [27].

It has been reported that CI in the elderly people cause a decline in quality of life, loss of efficiency, and, eventually, a rise in mortality rates [28]. According to MMSE scoring system, participants in this study had mild CI, with a mean score close to the normal cognitive functioning. Approximately, more than two third (68.75%) of the participants had normal MMSE scores (>25.0) of cognitive functions, while about one third (31.25%) had low scores below this normal threshold. This finding is in line with the result of a study conducted for 533 older adults in Baghdad city/Iraq which reported a normal cognitive function in 66.2% of the participants [29]. On the other hand, our finding diverged from those of previous studies conducted in different regions. For example, in China, Taiwan, and India the proportions of their elderly population that exhibited CI was lower than the current study [21-23]. On the contrary, the prevalence of older people with CI was found to be higher in Qatar, South India, and Indonesia than the present study [24-26]. This can be explained by fact other such as genetics, health care system, nutrition, exercise, and lifestyle would affect CI [36].

This study discovered a significant association between CI with increasing in age of older adults. Sengupta P, *et al.* [23] found that increasing age was related with both Alzheimer's disease and general dementia in a sample of age-stratified persons over the age of 55 [32]. In line with our results, other researchers have discovered an association between increasing age and CI as well [36-39]. Further, the current study revealed that around half of older adults who reported to be jobless, low socioeconomic status, and illiterate have CI. This is not consistent with the Taiwanese study [31], which reported that illiterate and low socioeconomic status older adults were around one third of the study sample. Besides, more than half of our study participants who stated to be widowed or living with others rather than their spouses were identified as having CI. This result is in line with a cross sectional study conducted by Mei, *et al.* in Malaysia [41]. The current study demonstrated no significant difference in prevalence of CI between smokers and nonsmokers. This finding contradicts an Iraqi study from Baghdad city, which reported much greater percentages of CI among nonsmokers [29]. The discrepancy could be due to differences in study populations, methodologies, or cultural and environmental factors. It's also possible that the Iraqi study's sample had unique characteristics influencing the relationship between smoking and cognitive health. Further research is needed to explore these variations and understand the underlying factors contributing to the differing findings.

The findings demonstrated that there is a significant relation between CI and sensory functions as most participants with hearing and vision abnormalities were having CI. Respondents with normal cognitive function were almost reported normal hearing function and mild visual impairment. Moreover, the severity of CI is proportional with the frequency of older adults with decrease in hearing acuity. While, the difference in severity of CI is not related to visual acuity. A longitudinal study in China, found that hearing or visual impairment was connected with a higher likelihood of CI, the study

reported that 94% of the elderly with CI had hearing loss, and about 32.5% of dementia patients had vision loss. This can be explained by the study's methodology as in the current study both vision and hearing sensation were self-reported rather than using sensitive and specific tools to measure them [42]. Older adults with hearing loss may be deprived of auditory input, leading to less stimulation of the brain. This lack of stimulation could potentially contribute to CI. While there is evidence supporting a link between hearing loss and CI, it's essential to note that correlation does not imply causation [43]. Further research is needed to better understand the mechanisms involved in this relationship and to determine whether addressing hearing loss can help mitigate CI in older adults. Hearing impairment had a stronger association with CI than vision impairment. This might be due to the close connection between auditory system and other brain regions involved in memory, attention, and executive function. Lastly, hearing loss can pose significant challenges in communication, which is a key aspect of social interaction and cognitive engagement [44].

Moving to the relation between CI and depression, it is important to note that depression exhibits a high prevalence among the elderly population, yet it frequently remains concealed due to the presence of comorbid symptoms or is disregarded by both patients and healthcare professionals. The study's findings indicated that 21.5% of older adults were identified as having symptoms of depression. This proportion of depression is lower than that reported in a previous study conducted in the three Governorates (Sulaimani, Erbil, and Duhok) in the Kurdistan Region of Iraq which documented depression in 44.1% of the older adults [45]. The possible explanation could be attributed to differences in the study populations, methodologies, or the time periods during which the studies were conducted. Variations in socioeconomic conditions, access to healthcare, cultural attitudes towards mental health could also influence the prevalence of depression among older adults in different regions. On the other hand, in line with our study, a Chinese study recorded a prevalence of depression in 20.3 % of the Chinese old adults, which is consistent with the results of our study [46]. In contrast to our findings, a Norwegian study found that roughly 11.4% of older people had a depressive condition, which is lower than the rate reported in our study [47]. Nevertheless, according to the World Health Organization (WHO), there is a global prevalence of depression (5.7%) among older persons aged 60 years and above [48]. The elevated level of prevalence observed in developing nations can perhaps be attributed to challenges within the healthcare infrastructure, socioeconomic inequities, as well as the presence of armed conflicts and warfare.

On the other hand, this study revealed that nearly two-thirds of older adults with depressive symptoms also had CI. Similarly, another study found that older adults with depression were more likely to have CI, with an odds ratio of 1.22 compared to those without depression [49]. Depression can be a risk factor for developing or accelerating CI and dementia, as long-term or recurrent depressive episodes may lead to structural and functional brain changes affecting cognitive function [50]. Most older adults with depressive symptoms in the study had mild CI. Similarly, another study reported that older adults with severe depression had twice the risk of CI [51].

Another aspect of this study was examining the physical ability of the participants in relation to their CI status. Physical functional impairment as measured by ADLs was substantially more common in older persons with CI than in those without CI in the current study. Our findings were consistent with another study that found more dependent older persons in the CI group [52]. Moreover, in line with our finding, another study showed that the ADL scale scores in the non-cognitive and mild cognitive groups were considerably higher than those in the dementia group. Of course physical activity has been associated with better cognitive function, it promotes the release of neurotrophic factors and supports neuroplasticity, which are essential for maintaining cognitive health [53]. Moreover, the age-related changes are common in various physiological systems, including the cardiovascular, musculoskeletal, and neurological systems, these changes can contribute to both physical and CI [54]. in addition, diseases that affect the vascular system, such as hypertension and atherosclerosis, can impact blood flow to the brain and other organs, which may contribute to both physical and CI [55]. The neurodegenerative diseases such as Alzheimer's disease and vascular dementia, can affect both cognitive function and physical abilities [56]. Finally, chronic inflammation, which is common among older adults, has been implicated in various age-related conditions, including CI and physical frailty.

Inflammatory processes may affect the brain and other organs simultaneously, contributing to impairments in both domains [57].

This study has some limitation such as privacy Concerns; older adults may be hesitant to allow researchers into their homes due to their concerns about privacy. They may feel uncomfortable, sharing personal information, or having their living spaces examined. In addition, researchers need to prioritize the health and safety of both participants and themselves during home visits. This includes considerations for infectious diseases, environmental hazards, or other safety concerns within participants' homes Nonetheless, the study provides an insight to the prevalence of CI in the studied population which need to be taken into consideration by health care decision makers. Additionally, the study examined the association between CI and some risk factors which have not been examined in the study population.

The study focused exclusively on urban areas to ensure consistency in data collection and to control for variables such as access to healthcare, socioeconomic status, and lifestyle factors that might differ significantly between urban and suburban or rural areas. These areas might have different prevalence rates and risk factors for cognitive impairment due to variations in healthcare access, education levels, occupational hazards, and social support systems. Including a more diverse geographic sample in future studies would provide a more comprehensive understanding of cognitive impairment across different settings.

5. Conclusions

The prevalence of CI among older individuals in the study population is high. The CI is associated with female, unemployed, low socioeconomic level, illiterate, and widowed subjects. The CI is substantially associated with increasing age, low hearing and visual acuity, depressive symptoms, and physical functional impairment in older persons. The severity of CI among older adults is significantly related to age, impairment in hearing acuity, the presence of depressive symptoms, and smoking.

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