Original Article

Performance of a Sample of Low Educated and Illiterate Egyptian Elderly in Montreal Cognitive Assessment-Basic.

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Abstract

Background: Most older adults with dementia reside in low- and middle-income countries where illiteracy and low educational background are common. It is quite challenging to diagnose dementia and mild cognitive impairment in this specific group for multiple reasons including difficult access to health care resources and the availability of an appropriate cognitive tests without high verbal and educational demands.

Aim: to evaluate the performance of low-educated and illiterate elderly in Egypt using the Montreal Cognitive Assessment Basic (MoCA-B).

Patients and methods: cross-sectional design included 100 elderly participants recruited from Ain Shams University clinics especially geriatrics clinic. Demographic data of the participants were collected. Assessment of cognition with grading the severity of cognitive impairment by clinical dementia rating (CDR) was done, with assessment of cognition by Montreal Cognitive Assessment Basic (MoCA-B) to evaluate performance and diagnostic accuracy.

Results: Diagnostic performance of MOCA-B score was moderate in all the participants, high in 6-9 years and 1-5 years of education, and lowest in illiterates. The cut point in participants with 6-9 years of education was lower than that of standard MOCA-B scoring, to be ≤23, it decreased to be ≤22 in participants with 1-5 years of education, then to ≤21 in illiterate participants.

Conclusions: The Arabic MoCA-B has proven a moderate diagnostic performance for detecting Mild Cognitive Impairment in illiterate and low educated Egyptian elderly after modifying the cutoff points to (≤23 in 6-9 years of education, ≤22 1-5 in years of education and ≤21 in illiterate).

Key words: cognitive impairment, elderly, MOCA-B, illiterates.

INTRODUCTION

In Egypt, the Central Agency for Public Mobilization and Statistics (CAPMAS) reported in 2021 that the elderly population aged 60 years and above had risen to approximately 6.8 million, comprising around 3.6 million males and 3.2 million females. This demographic group constitutes 6.7% of the total population and is anticipated to increase to 17.9% by the year 2052. The life expectancy for elderly individuals has shown an increase from 73.9 years in 2019 to 74.3 years in 2021, with females having a slightly higher life expectancy of 75.9 years compared to males at 73.4 years [1].

Aging affects cognitive abilities differently as some of these abilities remain stable or may improve with age such as vocabulary, while others such as memory and processing speed gradually decline over years. There is a significant variation between elderly in the rate of decline in those abilities depending on multiple factors such as genetic factors, medical illness, psychological factors, and sensory deficits such as vision and hearing impairment, as well as education, physical activities, nutrition, smoking and occupation [2,3,4].

The prevalence of dementia increases after age of 65 as it doubles every 5 years. The prevalence of dementia represents 5–10% in people aged 65 years or more in higher income countries. With increasing the life expectancy worldwide especially in the low and middle-income countries (LMICs), the prevalence of dementia is expected to increase in these countries, while in the high-income countries it is expected be leveling off or even decrease. By 2050 two-third of the people with dementia are expected to be from the developing countries. In Egypt data on dementia rates are deficient, as the dementia is not considered a health challenge due to the high proportion of youth in the population, also there is a public belief that the dementia is a sign of normal aging that's led to underestimating it as a priority. The greying of the population make dementia a future challenge [5,6].

MCI progresses to dementia by ratio about 5% to 17% per year. MCI is classified according to the number of domains impaired to single-domain or multiple cognitive domains with memory affection (amnestic) or without memory impairment (non-amnestic). In adults older than 60 the percentage of MCI is about 6.7% to 25.2%. This percentage is affected by age and lower level of education [7].

In Egypt the illiteracy rates decreased from 49.9% to 25.8% from 1986 to 2017. Urban illiteracy represents17.7% while rural areas represents32.2% according to 2017 census, the illiteracy rate is higher in females than males as the illiteracy in males represents 21.1% in 2017 compared to females which represents 30.8% for the same period. Elderly population aged 60 years old have high illiteracy ratio as they represent (about 63.4%) of elderly [8].

Education plays a crucial role in influencing both the functional and structural development of the brain. The cognitive reserve hypothesis posits that individuals with a higher level of education have brains that are more resilient and better equipped to handle disruptions or compensate for cognitive dysfunction. This may explain why engaging in cognitively stimulating activities has protective and enhancing effects on cognition, particularly in illiterates [5,9].

Assessing dementia in illiterate individuals poses challenges, as traditional screening tools often require literacy skills. Illiterate individuals are more likely to receive false diagnoses of dementia, as these tools may not effectively account for their cognitive abilities, so illiterate people find difficulties when there is assessment in the cognitive domains that need literacy skills, even when assessment of these domains does not directly involve reading or writing [9].

The original test of MoCA for MCI assessment was adjusted to be suitable for patients with more than 13 years of formal education so there was another tool developed from it which is called Montreal Cognitive Assessment Basic (MoCA-B) to facilitate the detection of MCI in illiterate and low-educated individuals with specificity (86%) and sensitivity (81%) to detect MCI [10].

So, the aim of the study is to assess performance of low educated and illiterate

Egyptian elderly in Montreal Cognitive Assessment- Basic (MoCA-B) test.

PATIENTS AND METHODS

The study was designed as a cross-sectional observational investigation involving 100 elderly participants aged 60 years and above. Both males and females were recruited from Ain Shams University Hospital clinics. Participants had clinical dementia rating scale (CDR) score of 0-1 and were either illiterate or low educated elderly (Maximum nine years of education). Excluded from the study participants with delirium, depression, CDR more than 1, sensory impairment (visual or hearing impairment), aphasia, cerebrovascular stroke, acute illness that interfere with assessment. An approval for the study was granted before starting the subjects' recruitment process.

Grading severity of cognitive impairment was performed by the CDR, it consists of 6 domains: Memory, Orientation, Judgment & Problem Solving, Community Affairs, Home & Hobbies, and Personal Care. The total CDR global score was determined using a standardized algorithm, with memory being accorded primary importance, while the remaining categories were treated as secondary. A score of 0 = Normal, 0.5 = mild cognitive impairment, 1 = Mild Dementia [11].

The assessment of cognition in the study utilized the MoCA-B test (12)**.** The MoCA-B is a cognitive screening tool that has been translated and validated into an Arabic version specifically designed for application in individuals with lower levels of education or illiteracy (13)**.** The MoCA-B consists of a 30-point test that assesses six cognitive domains. When computing the total score, an additional 1 point is added for individuals with less than 4 years of education, and another 1 point is added for those who are considered illiterate.

Instructions of MoCA-B as follows:

1.Executive function:1 point

2.Immediate Recall: the examiner gives a list of 5 words to be immediately recalled and to be remembered later. No points.

3.Fluency: the examiner asks the participant to say names of fruits as much as possible in one minute only. 2 points are taken for 13 words or more, 1 point for 8-12 words, No points for 7 words or less.

4.Orientation: the participant has to be oriented for the exact day of the week, month, year, place (name of hospital, clinic) and city,1 point is taken for each correct answer.

5. Calculation: The test administrator must provide three possible combinations for making a payment of 13 LE using various denominations, including 1 LE coins, 5 LE bills, and 10 LE bills. Participants earn 3 points for providing three accurate combinations, 2 points for two correct combinations, and 1 point for each correct answer if only one combination is given correctly.

6.Abstraction: Participants are required to identify three pairs of words from three distinct categories. For each correctly identified category, one point is awarded.

7.Delayed Recall: A point is awarded for each word that is recalled without the use of any cues.

8.Visuo-perception: Points are assigned based on the participant's ability to identify overlapping objects within a group. Specifically, 3 points are awarded if the participant can correctly identify 9-10 objects, 2 points for 6-8 objects, 1 point for

4-5 objects, and no points are given for 3 objects or fewer.

9.Naming: the participant should name 4 animals (or insects):1 point is taken for each correct answer.

10.Attention: In the first category, where numbers with a white background are presented, participants earn 1 point if they can correctly identify numbers within circles with 1 error or fewer. In the second category, which features numbers with a black background, participants score 2 points if they can successfully identify numbers within both circles and squares with 2 errors or fewer.

Participants were classified into 3 groups according to their educational level, group A were illiterate (cannot read and write), group B had 1-5 years of education (we included this group of cases to report the performance of those who engaged primary education but escaped completing it.so they can hardly read and write but did not get a certification of primary education completion and many elderly Egyptians did so), and group C had 6-9 years of education. The diagnostic performance and accuracy of the MoCA test was measured in each group.

Statistical analysis

The collected data underwent coding and organization into tables, followed by statistical analysis using IBM Statistical Package for Social Sciences (SPSS) statistics software version 28.0, developed by IBM Corp., USA, in the year 2021.

1-Quantitative data tested for normality using the Kolmogorov-Smirnov test, then were described as mean±SD (standard deviation) as well as minimum and maximum of the range. Comparison using ANOVA test was performed after that.

2-Qualitative data were described as number, percentage and were compared using Chi square test. Fisher's Exact test was used for variables with small, expected numbers. ROC curve was used to evaluate the performance of different tests differentiating MCI. The level of significance was taken at p-value <0.050 was significant, otherwise was non-significant. Post hoc Bonferroni test was used for pairwise comparison.

3-Diagnostic characteristics were calculated as follows: Sensitivity = (True positive test / Total positive golden) x 100, specificity = (True negative test / Total negative golden) x 100. Diagnostic accuracy = ([True positive test + True negative test] / Total cases) x 100, youden's index = sensitivity + specificity – 1, predictive positive value = (True positive test / Total positive test) x 100 and predictive negative value = (True negative test / Total negative test) x 100

RESULTS:

The current study is a cross sectional observational study, involved 100 participants aged 60 years & older, the mean age of the participants was 68.4 (±5.7). As regard sex 59% of the studied participants were females. As regard the level of education (52.0%) of the participants were illiterate, (7.0%) had 1-5 years of education, while (41.0%) had 6-9 years of education. Regarding working status of the participants (65.0%) of the them did not work before. For living arrangement, marital status and smoking (89.0%) live with their families while the others either lived alone or in nursing homes, (47.0%) were married and (29.0%) were current smokers. **(Table 1).**

Regarding relation between educational level and CDR scale findings it showed that 38.5%) of the illiterate participants had normal cognition, 46.2% had MCI and 15.4% had mild dementia. In participants with 1-5 years education 28.6% were normal, 42.9%3 had MCI and 28.6%2 had

mild dementia. Participants with 6-9 years of showed 65.9% to be normal, 11 26.8% had MCI and 7.3% had mild dementia. By comparing the scores of CDR among the participants and their level of education, the majority of participants with a normal Clinical Dementia Rating (CDR) score belonged to the higher education group, and this difference was found to be statistically significant compared to illiterates, with a (p-value of 0.046). No other statistically significant differences were found among the three education groups. **(Table 2).**

Regarding relation between education and MOCA-B findings among participants **(Table 3)** showed that executive score was highest in 6-9 years of education with mean (0.4±0.5) (p-value 0.002) than illiterate and 1-5 years of education, also visuoperception, attention and total MOCA scores were significantly higher in the group of 6-9 years of education (p-value 0.001) for each than illiterates and 1-5 years of education.

Despite naming score was higher in participants with 6-9 years of education (p-value 0.001) yet it had significant difference with illiterates only while participants with 1-5 showed no significant difference in their performance regarding the other two groups. **(Table 3)**

Fluency, orientation, calculation, abstraction and delayed recall scores were significantly higher in participants with 6-9 years of education than 1-5 years of education with mean scores of (1.2±0.8), (5.3±1.1), (2.5±0.7), (2.1±0.6), (2.3±1.6), and p-values of (p-value 0.002), (p-value 0.006), (p-value 0.001), (p-value 0.003) and (p-value 0.041) respectively, no significant difference between illiterates and other education groups was found regarding these domains. **(Table 3)**

Regarding the diagnostic performance of participants in MoCA-B **(Table 4)** it showed that the diagnostic performance of MOCA-B score was moderate in all participants, area under the curve (AUC) (0.767), high in 6-9 years of education and 1-5 years of education AUC (0.853) and (0.850) respectively, and lowest in illiterates AUC (0.620). The cut point in 6-9 years of education ≤23 was lower than that of standard MOCA-B scoring ≤24 but it decreased by the decrease of education grades.

The diagnostic characteristics of MOCA-B in diagnosing MCI according to CDR is decreased by the decrease of educational level. The diagnostic characteristics of the lowest cutoff points (≤21) were lower in sensitivity and negative predictive value, but higher in Specificity, Youden's index and Positive Predictive value than higher cutoff point (≤24) in all participants. MOCA-B showed a sensitivity of (92.2%), Specificity of (49.0%), Youden's index of (41.1%), Positive Predictive value (PPV) of (65.3%) and Negative Predictive value (NPV) of (85.7%) **(figure 1) (Table 5).**

Illiterates showed a sensitivity of (96.9%) which is lower than the standard, but regarding specificity it was (20.0%) **(figure 2)**, Youden's index (16.9%), Positive Predictive value (PPV) (66.0%), Negative Predictive value (NPV) (80.0%) and these characteristics were higher than standard. Regarding participants with 1-5 years the sensitivity was (100.0%) the same of standard, while Specificity (50.0%) **(figure 3)**, Youden's index (50.0%), Positive Predictive value (PPV) (83.3%), Negative Predictive value (NPV) (100.0%) all also were higher than standard .Participants with 6-9 years had sensitivity of (92.9%) and Negative Predictive value (NPV) of (94.7%) and those were lower than standard, but Specificity was (66.7%) **(figure 4)**, Youden's index (59.5%), Positive Predictive value (PPV) (59.1%) which were higher than the standard **(Table 5).**

Table (1): Demographic characteristics of the participants

Total number of participants (100) so percent and number for each is equal.

Characteristics		Mean±SD	Range
Age (years)		68.4±5.7	60.0–80.0
		N	**%**
Age group (years)	**60-65**	41	41.0%
	66-70	23	23.0%
	71-75	24	24.0%
	76-80	12	12.0%
Sex	**Male**	41	41.0%
	Female	59	59.0%
Education	**Illiterate**	52	52.0%
	1-5 years	7	7.0%
	6-9 years	41	41.0%
Working status	**Working**	17	17.0%
	Retired	18	18.0%
	Did not work before	65	65.0%
Living arrangement	**Living alone**	6	6.0%
	With Family	89	89.0%
	In Institution	5	5.0%
Marital	**Married**	47	47.0%
	Widow/widower	53	53.0%
Current Smoking		29	29.0%

SD: standard deviation

Table (2): Relationship between educational level and CDR scale findings among participants

Findings	Education grade			p-value
	Illiterate (A) (Total=52)	1-5 years (B) (Total=7)	6-9 years (C) (Total=41)	
Normal	20 (38.5%) a	2 (28.6%) ab	27 (65.9%) b	**§0.046***
MCI	24 (46.2%) a	3 (42.9%) a	11 (26.8%) a	
Mild dementia	8 (15.4%) a	2 (28.6%) a	3 (7.3%) a	

§Fisher's Exact test. *Significant. Homogenous groups had the same symbol "a,b" based on post hoc Bonferroni test, significant difference is only between a &b, while ab showed no significant difference with either a or b.

CDR=clinical dementia rating MCI= mild cognitive impairment

Table (3): Relationship between educational level and MOCA-B findings among participants

Characteristics		Education grade			p-value
		Illiterate (A) (Total=52)	1-5 years (B) (Total=7)	6-9 years (C) (Total=41)	
Executive function score		0.1±0.3a	0.1±0.4a	0.4±0.5b	**^0.002***
Fluency score		0.8±0.7ab	0.3±0.5a	1.2±0.8b	**^0.002***
Orientation score		4.5±1.5ab	4.1±1.7a	5.3±1.1b	**^0.006***
Calculation score		1.8±1.1ab	1.3±1.1a	2.5±0.7b	**^<0.001***
Abstraction score		1.6±0.8ab	1.3±0.8a	2.1±0.6b	**^0.003***
Delayed recall score		1.6±1.5ab	1.0±1.3a	2.3±1.6b	**^0.041***
Visuoperception score		0.7±0.9a	0.6±1.0a	1.8±1.1b	**^<0.001***
Naming score		1.4±1.5a	1.7±1.6ab	2.8±1.4b	**^<0.001***
Attention score		0.3±0.8a	0.4±1.1a	1.8±1.4b	**^<0.001***
Total MOCA-B score		15.0±5.8a	10.7±6.4a	20.4±6.6b	**^<0.001***
Diagnosis	**MCI**	52 (100.0%)a	7 (100.0%)ab	26 (63.4%)b	**#<0.001***
	Normal	0 (0.0%)	0 (0.0%)	15 (36.6%)	

#Chi square test. *Significant. Homogenous groups had the same symbol "a,b" based on post hoc Bonferroni test.

Table (4): Diagnostic performance of Montreal cognitive assessment basic (MoCA-B) score in diagnosing MCI according to CDR scale.

Category	AUC	SE	p-value	95% CI	Cut point
All cases	0.767	0.047	**<0.001***	0.676–0.859	≤21
Illiterate	0.620	0.078	0.148	0.467–0.774	≤21
1-5 years	0.850	0.164	0.175	0.529–1.000	≤22
6-9 years	0.853	0. 058	**<0.001***	0.740–0.967	≤23

AUC: Area under curve. SE: Standard error. CI: Confidence interval. *Significant.

CDR=clinical dementia rating MCI= mild cognitive impairment

Table (5): Diagnostic characteristics of MOCA-B cutoff points in diagnosing MCI according to CDR scale.

Characteristics	All cases		Illiterate		1-5 years		6-9 years	
	≤24	**≤21**	**≤24**	**≤21**	**≤24**	**≤22**	**≤24**	**≤23**
Sensitivity	100.0%	92.2%	100.0%	96.9%	100.0%	100.0%	100.0%	92.9%
Specificity	30.6%	49.0%	0.0%	20.0%	0.0%	50.0%	55.6%	66.7%
Diagnostic accuracy (DA)	66.0%	71.0%	39.0%	67.3%	71.4%	85.7%	70.7%	75.6%
Youden's index	30.6%	41.1%	0.0%	16.9%	0.0%	50.0%	55.6%	59.5%
Positive Predictive value (PPV)	60.0%	65.3%	39.0%	66.0%	71.4%	83.3%	53.8%	59.1%
Negative Predictive value (NPV)	100.0%	85.7%	0.0%	80.0%	0.0%	100.0%	100.0%	94.7%

MoCA-B =Montreal cognitive assessment basic CDR=clinical dementia rating
MCI= mild cognitive impairment

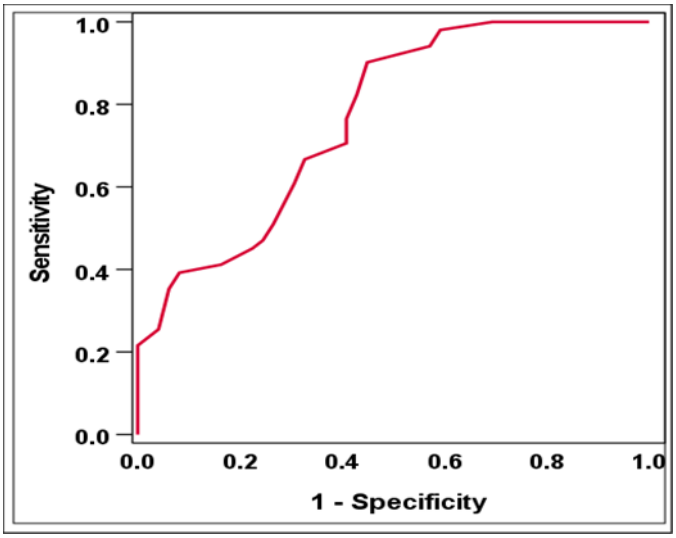

Figure (1): Receiver operating characteristics (ROC) curve for MOCA-B score in diagnosing cognitive impairment according to CDR in all the study cases.

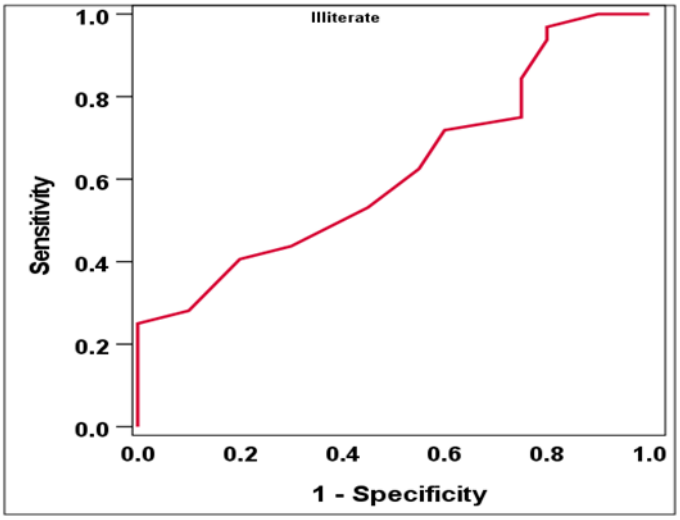

Figure (2): Receiver operating characteristics (ROC) curve for MOCA-B score in diagnosing cognitive impairment according to CDR in illiterate participants

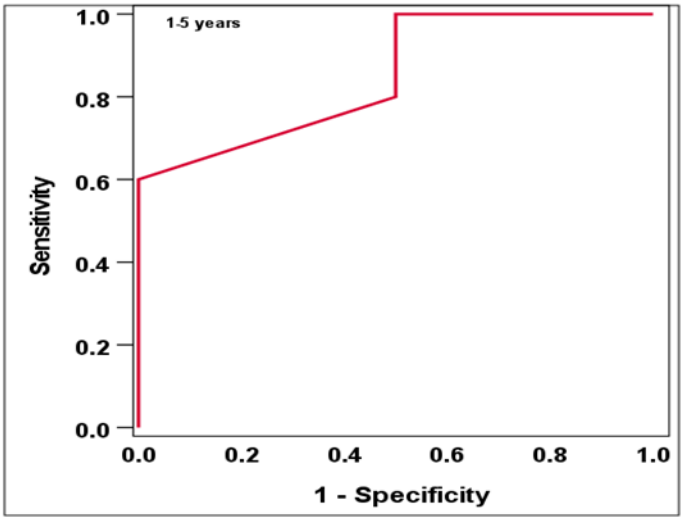

Figure (3): Receiver operating characteristics (ROC) curve for MOCA-B score in diagnosing cognitive impairment according to CDR in participants with 1-5 years of education.

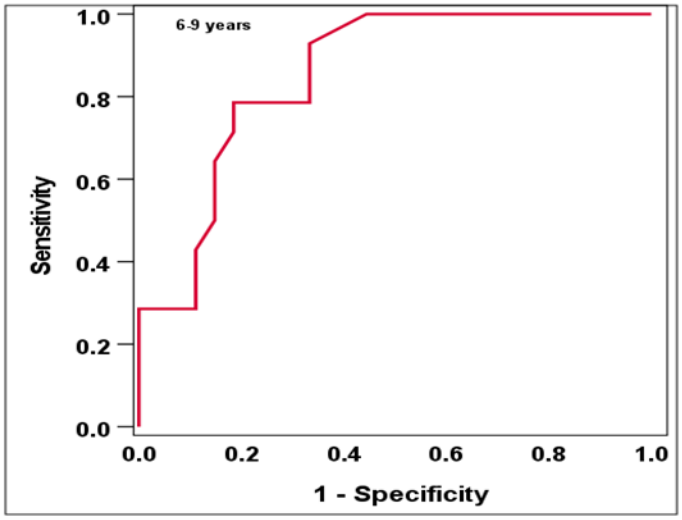

Figure (4): Receiver operating characteristics (ROC) curve for MOCA-B score in diagnosing cognitive impairment according to CDR in participants with 6-9 years of education**.**

DISCUSSION

The prevalence of dementia is increasing worldwide especially in the LMICs. One of the difficulties in assessment of cognitive impairment is the educational level as most of the tools give over estimation of cognitive impairment to illiterate population. MoCA-B was introduced as a newer version by the MoCA organization with modifications from the original MoCA test in some cognitive domains for assessment of cognitive impairment in illiterate and low educated individuals and was validated by Saleh and colleagues in (2019) [12] into the Arabic version.

The current study was a cross sectional observational study included 100 participants, all aged 60 years and older, with a mean age of 68.4 years (±5.7). More than half of the participants were illiterate (52.0%), (7.0%) had 1-5 years of education, while (41.0%) had 6-9 years of education. Females represented 59% of participants, most of them did not work before, most of participants lived with their families and 29.0% of them are current smokers.

According to CDR, 65.9% of participants with 6-9 years of education had normal cognition and it was significantly higher than in illiterates. Participants with 1-5 education years showed no significant differences in their cognitive performance with illiterates or those with 6-9 years education.

The current study revealed that the higher the level of education the better the cognition as participants with 6-9 years of education performed significantly better than those who were illiterate. However, participants with 1-5 years of education did not show any significant difference compared to the 2 other educational groups. This could be because the sample size in this group particularly was smaller than the other two groups.

Our findings were comparable to a study conducted by ***Opdebeeck et al.*** [13]. The meta-analysis, encompassing 109 studies with a (total of 111,684) participants, investigated the relationship between educational level and various measures of cognitive performance. The majority of samples were drawn from Western populations. The findings for general cognitive functions indicated that each additional year of education was associated with cognitive performance estimates ranging from approximately 0.04 to 0.08 standard deviations higher. In practical terms, an individual with an extra 5 years of education, such as a university degree, would be expected to exhibit cognitive performance scores 0.2 to 0.4 standard deviations higher, equivalent to 3 to 6 IQ points, compared to someone with less education, like a high school diploma.

The difference between our study and this study was that those with 1-5 years of education did not show any significant better cognitive performance compared to the illiterates. This was because the sample size in this group was lower than the other two groups. Also another difference is that ***Opdebeeck*** study was carried on the western population that have regional and cultural differences and different educational pattern. Some studies have indicated a positive correlation between the number of years of formal education completed by individuals and their cognitive function across adulthood. Furthermore, these studies suggest that a higher level of education is associated with a reduced risk of developing dementia later in life. These findings have led to the hypothesis that extending education may enhance cognitive reserve and mitigate the declines in cognition that are typically associated with aging [13,14,15].

Lenehan et al. [15] showed that people with high level of education especially with 12 years of education had a 47% decrease in dementia risk irrespective of the disease burden compared to those with a lower level of education, as there is an association between the educational level and the brain pathology and neuropsychological test performance, so education is considered to be a protective factor against dementia.

Most of the studies showed that education has positive effect on cognition but some studies showed that this effect may be decreased after reaching high level of education, such as ***Barnes et al.*** [16] who found the effect of education on different races white and black below 12 years of education had a good association with cognition, but later on after 12 years of education (higher education) this effect is only related to a special race which is the black. The results of the previous study agree with study carried by ***Kobayashi et al.***[17] which also showed that although there is an association between education and cognition it may be also affected by other factors such as sex , race and the society.

A study conducted by ***Muniz-Terrera et al.*** [18] showed that education affects only cognitive performance, but it has no effect on the rate of deterioration or decline in cognition. Also, ***Gross et al.*** [19] suggested that race and education do not have strong effects on cognitive decline.

Regarding relation between education and MOCA-B findings among participants it showed highly significant difference in performance of participants with 6-9 years of education in all the items of the test compared mainly to the illiterate participants.

The performance of participants in MOCA-B test is definitely affected by education, in the current study the diagnostic performance of the participants in MoCA-B showed that area under curve (AUC =0.767) for the total 100 participant were with cutoff point ≤21 showing significant difference between normal and MCI. Comparing each group (according to level of education), participants with 6-9 years of education, using a cutoff point of ≤23, demonstrated significantly higher performance (AUC 0.853) in comparison to those with 1-5 years of education, where the cutoff point was ≤22 (AUC 0.850). However, in illiterates, the performance was comparatively lower, with a cutoff point of ≤21 yielding an (AUC of 0.620).

The MoCA-B test, translated into various languages, has demonstrated high reliability in diagnosing Mild Cognitive Impairment (MCI). In a validation of the Arabic version of MoCA a study conducted by ***Saleh et al.*** [12] involving 205 elderly participants (137 educated and 68 with low education, less than 6 years), the recommended single cutoff point for all subjects was 21/22. This yielded a sensitivity of 92.5% and specificity of 98.2% for detecting mild neurocognitive disorder (NCD). In our study, we found similar cutoff points for all cases, with a sensitivity of 92.2% and specificity of 49.0%. For participants with low education (less than 6 years), the recommended cutoff in the validation of the Arabic version of MOCA-B was 18/19, achieving a sensitivity of 87% and specificity of 100%. In our study, the cutoff point for illiterate participants was ≤21, with a sensitivity of 96.9% and specificity of 20.0%. For participants with 1-5 years of education, the cutoff point was ≤22, with a sensitivity of 100.0% and specificity of 50.0%.

The difference between their study and the current study may be due to the difference in classification of the participants according to the educational level as they considered illiterate people and less than 6 years of education as one group, while in our study

about 52% of our participants were illiterate and about 7 % had 1-5 years of education.

The original study of MoCA-B ***Nasreddine et al.*** [20] was conducted on 85 elderly participant and showed that the cutoff scores for MCI diagnosis was below 25 out of 30. The MoCA-B demonstrated robust performance in identifying individuals with Mild Cognitive Impairment (MCI), with good to excellent sensitivity (86%) and specificity (86%). The positive predictive value was satisfactory at 85%, and the negative predictive value was 82%. The overall accuracy of the MoCA-B reached 84%. The diagnosis of MCI was based on assessments using the Clinical Dementia Rating (CDR) and the Mini-Mental State Examination (MMSE).In our study the cut-off point ≤21 was for illiterate participants with sensitivity of 96.9% and specificity of 20.0%, the positive predictive values was (65.3%) and negative predictive value was (85.7%) with accuracy 71.0%, while in participants with 6-9 years of education the cut-off point was ≤23 with sensitivity 92.9% and specificity of 66.7%, The positive predictive value was (59.1%) and negative predictive value was (94.7%) with accuracy 75.6%.

The difference between the original study and our study could be due to the difference in the community. The study was conducted on population with different educational level and the different educational approaches, also our comparison was based only on CDR.

Also, in a study conducted in Saudi Arabia by ***Alkhunizan et al.*** [21] the adjusted cutoff points for Mild Cognitive Impairment (MCI) were set at less than 14 for illiterate individuals, less than 20 for individuals with 1–6 years of education, and less than 25 for individuals with 7 or more years of education. The divergence between the findings in this study and our study may also be attributed to cultural differences, as well as the educational backgrounds which influence cognitive performance assessments and the establishment of appropriate cutoff points for different populations.

In a study performed in Egypt in 2021 ***El-sayed et al.*** [22] involving 310 elderly participants aged 60 and older, specifically illiterate and low educated individuals, the MoCA-B was utilized in conjunction with MMSE and CDR. The recommended cutoff values for the MoCA-B test to detect Mild Cognitive Impairment (MCI) were identified as 20 out of 30 points for illiterate participants, achieving 100% sensitivity and 97.46% specificity. For low-educated elderly, the recommended cutoff was 21 points, with 100% sensitivity and 95.71% specificity. The difference between this study and current study is that they classified participants to illiterate elderly and low educated (4 years or less of education), also it included patients with moderate and severe dementia.

CONCLUSION

The Arabic MoCA-B has proven a moderate diagnostic performance for detecting Mild Cognitive Impairment in illiterate and low educated Egyptian elderly after modifying the cutoff points to (≤23 in 6-9 years of education, ≤22 1-5 years of education and ≤21 in illiterate).

Ethical consideration

Approval for the study was granted by the ethical committee at the Faculty of Medicine, Ain Shams University, with the assigned (approval number MS614/2022). Additionally, permission to use the MoCA test was obtained from the MoCA organization, and the primary investigator received certification in the MoCA test, with

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Author contributions

Nada H. Nassar was responsible for sample and data collection from the patients and writing the manuscript. Nesma G. El-sheikh., Shereen M. Mousa and Heba M. Tawfik contributed significantly to the study conception, design, data analysis and interpretation and assisted in manuscript drafting and revision.

Declaration of Conflicting Interests

The authors have stated that they have no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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