

# Mini-Mental State Examination (MMSE) Scores in Healthy Educated Adult Jordanian Population

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## Abstract

**Background:** The Mini-Mental Status Examination (MMSE) is a simple informative and validated screening test of cognitive functions. No data from MMSE scores in healthy populations has been published about educated Jordanians. Objective: To study the MMSE scores in the healthy educated Jordanian population.

**Method:** 150 healthy educated adult Jordanians were interviewed and tested for their MMSE score. Their scores were analyzed and the effect of age, sex and education on the score was studied. Results: 150 adult subjects aged 35±12.5 years (range 18-71 years) with a mean level of education 14.2±2.6 years (range 7-20 years) scored 27.8±2.2 / 30 (range 21-30). No correlation was found between age and MMSE score (Pearson correlation =-0.08, p=0.32), while there was direct correlation with education level (Pearson 0.53, p=0.000). There were 77 (51.3%) males and 73 (48.7%) females who scored 27.7±2.4 and 27.8±2.1 respectively (p=0.942 ANOVA). There was also no correlation with age at a cutoff of 45 years (p=0.203) while people with higher education (> 12 years, n=105) scored better than those with basic education (7-12 years, n=45), 28.4±1.8 and 26.3±2.5, respectively (p=0.000).

**Conclusion:** Local MMSE scores for healthy educated adult Jordanians are presented here that can be of help to the practicing physician assessing patients' cognitive functions. The local data confirmed previous associations with education but not with age as this series consists mostly of those from the young adult population. We suggest a lower normal score of 21 for those with basic education and a score of 24 for those with higher education.

**Keywords:** Mini-Mental State Examination, MMSE, educated adult Jordanians.

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## Introduction

Mini-Mental Status Examination (MMSE) is a well-known simple tool used to assess cognitive function. Since it was developed in 1973,<sup>1</sup> it has been shown to be reasonably sensitive in screening for cognitive dysfunction. This test has

been validated in different cultures and societies,<sup>2, 3</sup> including Arabic cultures.<sup>4, 5</sup> Normal data has shown that the score is related to both age and level of education.<sup>6</sup> There exists no normative data in Jordan and it is not known whether age and level of education are also important determinants of the score in Jordanians.

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In this study, the findings of MMSE scores in healthy educated adult Jordanians are reported so that it may be used as a guide for those who want to use this test in their daily clinical practice.

## Methods

Healthy (defined as those who are not known to have any chronic medical illness and are not taking any regular medication and have not suffered any brain disease that has left any deficit) and educated (defined as those who had a minimal formal education of 6 years or more) adults (defined as those who are 18 years of age or older) were recruited for the study. Two of the investigators, MZ and YK, explained the test to the candidates. After obtaining their oral consent, the test was presented in its Arabic version. The test generally took between 10-20 minutes. The patients' demographic data including age, sex, level of education, and their score on the high school examination were recorded. The test was done in the field; which included patients' waiting areas, the work place of some volunteers and other areas such as mosques. Data was collected on a separate sheet for each volunteer and then analyzed using the SPSS 11.5 package. We calculated the total score and the score for each of its components which included orientation, registration, attention, language and recall. The mean and standard deviation were calculated and the correlation with age, sex and education level, using the Pearson correlation factor, was derived. The data was then analyzed following the division of patients into groupings; the 'young' defined as those below or equal to the age of 45 and 'old' as those above the age of 45; those with 'basic education' defined as those who had education of 6-12 years and 'higher education' defined as those with greater than 12 years of formal education. Gender results were also determined. An independent sample t test was used to look for any significant difference between the means of the groups using a 2-tailed p-value of <0.05 as being significant.

## Results

We interviewed 150 candidates who fulfilled the inclusion criteria. There were 77 males (51.3%)

and 73 females (48.7%). Table (1) summarizes the general features and findings in the population. The mean score of MMSE for the whole group was  $27.8 \pm 2.2$ . There were correlations with the score and level of education (Fig 1A, 2C) and high school general examination score (Pearson 0.53, 0.46 respectively,  $p=0.00$ ) but the result did not show correlations with age (Fig 1B, 2A) or gender (Fig 2B). On the univariate analysis of variance, there was no interaction between sex and education ( $p=0.27$ ), age and education ( $p=0.185$ ), age and gender ( $p=0.351$ ) or age, sex and education ( $p=293$ ). The mean score of components of the test including orientation, registration, attention and language did not correlate with age while recall correlated negatively with age (Pearson  $r=-0.2$ ). Though men were significantly older than women ( $34 \pm 13.9$  vs.  $30 \pm 10.2$ ,  $p=0.005$ ), the groups did not differ in education level, high school score, MMSE or its components' sub-scores. Those who were considered young ( $\leq 45$  years) when compared to the older group ( $>45$  years) did not differ in their MMSE or its components' sub-scores (Fig 2B). Those who were considered to have had a basic education level (6-12 years) ( $n=46$ , 30.7%) when compared to those with higher education ( $>12$  years,  $n=104$ , 69.3%), scored significantly lower on MMSE;  $26.5 \pm 2.6$  vs.  $28.3 \pm 1.8$  ( $p=0.00$ ) (Fig 2C). This was valid also for all the sub-scores except for registration where both groups did not differ ( $p=0.13$ ). The high education group also scored better on their high school scores ( $777.2 \pm 102.3$  vs.  $698.3 \pm 111.8$ ,  $p=0.003$ ).

**Table (1): Main features of subjects studied (values are recorded as means and standard deviations).**

<b>Feature</b>	<b>Mean <math>\pm</math> SD (range)</b>
Age (y)	$35.0 \pm 12.5$ (18-71)
Education level in years	$14.2 \pm 2.6$ (7-20)
High school score (max 1000) (n=114)	$763.3 \pm 107.8$ (490-967)
MMSE score (max 30 points)	$27.8 \pm 2.2$ (21-30)
Orientation score (max 10 points)	$9.8 \pm 0.5$ (8.0-10.0)
Registration (max 3 points)	$2.99 \pm 0.1$ (2-3)
Attention (max 5 points)	$3.82 \pm 1.6$ (0-5)
Language (max 9 points)	$8.9 \pm 0.39$ (7-9)
Recall (max 3 points)	$2.3 \pm 0.98$ (0.0-3.0)

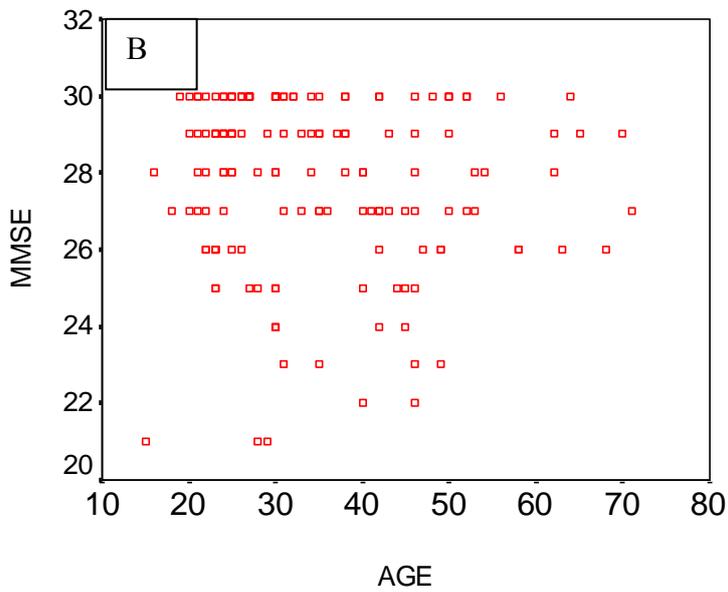
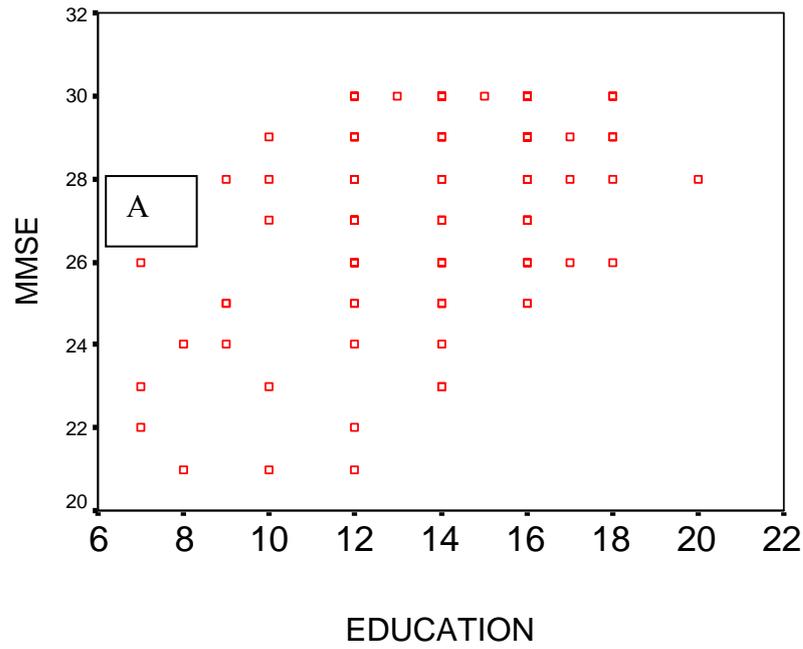
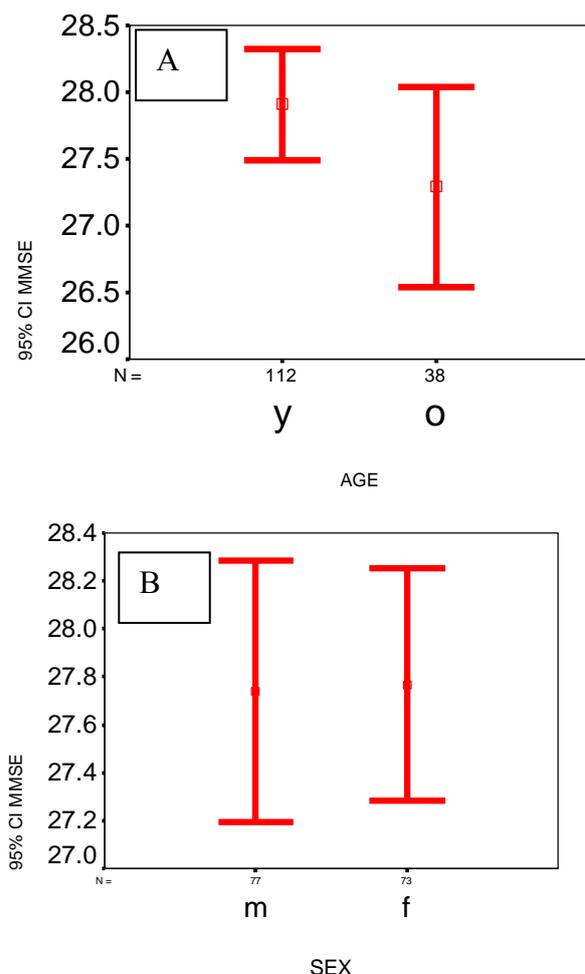


Fig. (1): Scatter diagram showing relationship of MMSE score and education level (A) and age (B) in the whole population studied.



**Fig. (2):** Relationship between age and MMSE score and age A (young  $\leq 45$ , old  $> 45$ ), gender B (m=male, f=female), and level of education (b=basic 6-12 years, h=higher  $> 12$  years) (N= number in each category, bars represent mean (dot on vertical line) and 95% confidence interval between two horizontal parallel lines).

## Discussion

In this study it has been shown that the mean of the MMSE score in educated adult Jordanians was similar to that reported from other ethnic groups, including the larger Arabic population.<sup>4, 5</sup> The relationship with the level of education, either in the whole group or when comparing those with basic and higher education, was also previously documented.<sup>6</sup> Using this group of patients, this study failed to confirm the well-known negative relationship between the MMSE score and the age of the subjects. This may be due to the fact that this test population was quite young relative to other populations

studied.<sup>6</sup> The Jordanian population is quite young as reflected in the data from the Jordanian department of statistics where, according to 2007 official results, 42.2% of the population was less than 14 years of age, and 31.4% fell between 15-29 years of age, leaving only 26.4% over 30 years of age.<sup>7</sup> Another possible reason for the discrepancy could be that most of the Jordanian population is educated and the rate of illiteracy in the general population is 7.9% (4.3% in males and 11.6% in females), 52% have had less than secondary school education ( $< 12$  years) and 39.9% had higher education.<sup>7</sup> As this sample was derived from the central Amman area, no difference was found in the education level

between males and females. Both sexes scored the same in the MMSE though men were significantly older than women, again reflecting the fact that in the Jordanian population, education seems to be the most important determining factor in MMSE scores. So when deciding whether a Jordanian deviates from the normal expected MMSE score, his level of education rather than his age should be the primary consideration. Based on the findings of a MMSE score of  $26.3 \pm 2.5$  and  $28.4 \pm 1.8$  in those with basic and higher levels of education as defined here respectively, MMSE scores of 21 and 24 (Mean-2SD) are suggested as indicative cutoff points in the score between the cognitively normal and abnormal in both groups respectively. For those who are educated less than 6 years, including illiterate people, further studies are needed. It is interesting to note that most of the points lost in the score in this population were in the attention and recall sub-scores. This may reflect the sensitivity of these sub-scores to early cognitive decline.

The drawbacks of this study must be acknowledged. First, the number of volunteers was too small to make any solid conclusions. Second, the population studied does not necessarily represent the whole population of Jordan since the subjects were drawn from the capital city of Amman. Third, the population is relatively young, while this test is generally used in the elderly. Fourth, though it is claimed that this is a healthy normal population, no effort was made or investigation performed, apart from a simple history, to ensure the normal health of this population or their education level. Nonetheless, having this normal data for the Jordanian population is an important small step for further studies. In conclusion, the MMSE scores of 150 educated adult Jordanians is presented here and their education level is documented as relevant to the score. Furthermore, two separate normal cutoff points need to be considered for those with basic and those with higher education levels.

## Disclosure

There is no conflict of interest to be disclosed by any of the authors.

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## نتائج فحص القوى العقلية المصغر لدى الأردنيين البالغين المتعلمين الأصحاء

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### الملخص

يعتبر فحص القوى الذهنية المصغر فحصاً مبسطاً ومفيداً ومثبتاً كفحص مسحي للقوى العقلية. لا توجد معلومات دقيقة حول نتائج الأردنيين البالغين المتعلمين في هذا الفحص.

**الهدف من الدراسة:** دراسة تحصيل مجموعة من الأردنيين البالغين المتعلمين في هذا الفحص المعياري.

**طريقة البحث:** قمنا بدراسة عينة عشوائية تتكون من 150 أردنياً بالغاً متعلماً وأجرينا لهم هذا الفحص، ومن ثم قمنا بتحليل نتائج تحصيلهم ودرسنا أثر العمر والجنس ومستوى التعليم على مقدار هذا التحصيل.

**النتائج:** كان متوسط العمر في العينة  $12.5 \pm 35$  سنة (المدى 18 - 71 سنة) ومتوسط مستوى التعليم  $14.2 \pm 2.6$  (مدى 7 - 20 سنة) وقد كان متوسط تحصيل العينة  $27.8 \pm 2.2$  (المدى 21 - 30). من أصل 30 نقطة كتحصيل أعلى في هذا الفحص. لم يكن هناك علاقة بين العمر والتحصيل (مؤشر بيرسون -0.08,  $p=0.32$ ) ولكن كانت هناك علاقة طردية بين مستوى التعليم ومقدار التحصيل (مؤشر بيرسون = 0.53,  $p=0.000$ ). كان هناك 77 (51.3%) ذكراً و73 (74.7%) أنثى، وكان تحصيلهم  $27.7 \pm 2.4$  و  $27.8 \pm 0.2$  على التوالي. ( $p=0.942$  ANOVA). لم يكن هناك كذلك علاقة بين العمر والتحصيل عند تقسيم المجموعة الى فئتين من أفراد عمرهم 45 عاماً فما دون أو أكثر من 45 عاماً. عند تقسيم العينة بناءً على مستوى تعليم أساسي (7 - 12 سنة تعليم، 45 فرداً) ومجموعة ذات تعليم عال (أكثر من 12 سنة، 105 أفراد). كان تحصيل المجموعتين  $26.3 \pm 2.5$  و  $28.4 \pm 1.8$  على التوالي وكان الفرق بينهما ذا دلالة احصائية ( $p=0.000$ ).

**الاستنتاج:** قمنا بمعرفة مقدار التحصيل في هذا الفحص عند الأردنيين البالغين المتعلمين ونعتقد أن هذه النتائج مفيدة ومهمة للطبيب الممارس. وقد أكدت نتيجة هذه الدراسة النتائج السابقة المتعلقة بين العلاقة بين مستوى التعليم ومقدار التحصيل في هذا الفحص، واختلفت عنها في عدم وجود علاقة بين العمر ومقدار التحصيل في هذا الفحص وهذا يعود لحقيقة أن المجتمع الأردني مجتمع فتي. نقترح أن يكون الحد الأدنى الطبيعي لمقدار التحصيل في هذا الفحص 21 نقطة و 24 نقطة لكل من الفئتين ذواتي التعليم الأساسي والتعليم العالي على التوالي.

**الكلمات الدالة:** فحص القوى العقلية المصغر، MMSE، الأردنيين البالغين المتعلمين.