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Prayer at Midlife is Associated with Reduced Risk of Cognitive Decline in Arabic Women

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Abstract

Midlife habits may be important for the later development of Alzheimer's disease (AD). We estimated the contribution of midlife prayer to the development of cognitive decline.

In a door-to-door survey, residents aged 65 years were systematically evaluated in Arabic including medical history, neurological, cognitive examination, and a midlife leisure-activities questionnaire. Praying was assessed by the number of monthly praying hours at midlife. Stepwise logistic regression models were used to evaluate the effect of prayer on the odds of mild cognitive impairment (MCI) and AD versus cognitively normal individuals.

Of 935 individuals that were approached, 778 [normal controls (n=448), AD (n=92) and MCI (n=238)] were evaluated. A higher proportion of cognitively normal individuals engaged in prayer at midlife [(87%) versus MCI (71%) or AD (69%) ($p < 0.0001$)]. Since 94% of males engaged in prayer, the effect on cognitive decline could not be assessed in men. Among women, stepwise logistic regression adjusted for age and education, showed that prayer was significantly associated with reduced risk of MCI ($p = 0.027$, OR=0.55, 95% CI 0.33-0.94), but not AD. Among individuals endorsing prayer activity, the amount of prayer was not associated with MCI or AD in either gender.

Praying at midlife is associated with lower risk of mild cognitive impairment in women.

Keywords

Alzheimer's disease; Arabic; dementia; epidemiology; leisure; mild cognitive impairment; prayer

Introduction

High levels of spirituality and religiosity are correlated with lower morbidity and mortality [1, 2], lower cardiovascular-related mortality [3], enhanced quality of life and well-being [4], and lower levels of depression and psychological stress [4, 5]. Possible mechanisms by which spirituality/religiosity may affect health outcomes include a more favorable immune profile [6, 7], lower rates of depression [8, 9], higher compliance with treatment [10], quicker response to acute health crises [11-13], healthier lifestyles (e.g., healthy diets, less smoking and alcoholism) [14], enhancement of social ties and social well-being [14], optimism and hope [15, 16], stress reduction [17-19], enhanced cognitive stimulation, and lower rates of suicide [20].

Although spirituality and religiosity have been associated with better outcomes in many disorders, the impact of prayer at midlife on the development rate of cognitive decline at older age calls for investigation.

Materials and Methods

Study design

We carried out a door-to-door observational study of the elderly population of Wadi Ara villages in Northern Israel. It was approved by the Institutional Ethics Committee of the Sheba Medical Center according to guidelines from the Israel Ministry of Health and by the Institutional Review Boards of University Hospitals of Cleveland, Case Western Reserve University, Boston University and the University of Louisville. All participants signed a written consent form in Arabic. In the event of the individual being illiterate, the interviewer read the consent form to the individual, who then fingerprinted the form with the index finger of his/her dominant hand. Individuals were classified as defined below. None of the interviewed individuals have participated in previous studies.

Study population

Wadi Ara (the Ara Valley) is located in northern Israel and has a population of 81,400 Arab inhabitants of whom 51% were men on prevalence day (January 1st, 2003). This work is part of an epidemiological study of aging-related brain disorders in Wadi Ara [21-23]. The elderly cohort (aged ≥ 65 years) included 2,067 residents (2.5%) on prevalence day, according to the Israel Central Bureau of Statistics. A total of 935 persons in the elderly cohort were approached in a door-to-door fashion between January 2003 and December 2009. All participants live in the same valley under similar social conditions.

Participant evaluation

The research team comprised of a neurologist (MM) and an academic nurse (AA), both fluent Arabic speakers, examined all individuals in their own homes, all of whom resided either with their spouse or in the home of a close relative. None lived alone and none of the individuals were institutionalized, as is the norm in this population. A nurse collected information regarding family and medical history, medication use, daily activities (social, personal, occupational and recreational), behavior, cognitive abilities, and changes in the above as per a structured interview of the individual and a close relative. During the second visit, a neurologist performed a complete neurological examination, including the motor part of the Unified Parkinson's Disease Scale (UPDRS) on all individuals [24].

Cognitive instruments

Arabic translations of the Mini-Mental State Examination (MMSE) (maximum score = 30) and the Brookdale Cognitive Screening Test (BCST, maximum score = 24) were used. The

BCST was developed at the Brookdale Institute of Gerontology, Jerusalem for use in populations with high illiteracy rates [25]. The BCST includes items on orientation, language, memory, attention, naming, abstraction, concept formation, attention, praxis, calculation, right-left orientation, and visuo-spatial orientation. Arabic versions of both the MMSE and the BCST have been validated and norms have been published [23]. Since the MMSE involves several tasks that are dependent on literacy, individuals with no formal education scored “0” in these items. A highly significant correlation between MMSE and BCST scores in normal individuals has been previously reported by our group ($r = 0.852$, $p < 0.0001$). This correlation was of the same magnitude for men ($r = 0.8223$) and women ($r = 0.854$, both $p < 0.0001$) [23].

Diagnostic Process

Three neurologists (MM, RS and RI) reviewed the results of the field examination of each individual in a bi-monthly conference and generated a consensus diagnosis. All individuals were cognitively classified as healthy (cognitively normal, CN), Alzheimer's Disease (AD), Mild Cognitive Impairment (MCI), Vascular Dementia (VD), Parkinson's Disease (PD), other dementia or not classifiable according to accepted criteria [26-29]. Since MMSE and BCST scores are strongly dependent on education in both genders in this population [23], we did not use cut-off scores for cognitive classification. An individual was defined as cognitively normal if there were no complaints of memory or any other cognitive domain, no evidence of such disturbance according to informant history or neurological examination and no evidence of impairment in activities of daily living due to cognitive disturbances [23].

Individuals were classified as MCI if they had impairment in cognitive function on examination, with a Clinical Dementia Rating Scale (CDR) score of 0.5 [30], and an informant record of cognitive decline, but did not have functional impairment in activities of daily living that would qualify for dementia when assessed by the informant interview and/or physical examination [31, 32]. A diagnosis of dementia was assigned to individuals who fulfilled DSM-IV and ICD-10 criteria. Demented individuals were considered to have AD if they met NINCDS-ADRDA criteria for probable or possible AD [26, 33]. VD was diagnosed according to the International Classification of Diseases, 10th revision (ICD-10) criteria. Thus, a history consistent with cerebrovascular disease, pyramidal signs and previous cerebral imaging were actively sought to substantiate a diagnosis of VD. The category “not classifiable” included individuals with complex medical conditions or advanced systemic disease, in whom the cognitive impairment could not be determined as related to the underlying medical condition or to a neurodegenerative disease.

Life style questionnaire

Individuals were interviewed regarding participation in 15 leisure activities at midlife (between ages 20 and 60 years): gardening, writing letters, praying, participating in organized group discussions, discussion with friends, house repairs, painting, wood carving, carpentry, knitting, watching television, reading, card games, board games, listening to music. Individuals reported the number of hours per month they devoted for each activity. Practice of leisure activities, including prayer, was verified by family members.

Statistical analysis

Stepwise logistic models were used to estimate the odds of AD or MCI vs. normal controls as a function of age, school years, praying and their mutual interactions. We examined two models for the possible effect of praying on cognitive decline. In the first model, the dichotomous effect of praying was considered (practicing prayer at midlife or not). In a second model, in order to test a dose-effect of praying hours on cognitive decline, we

included only individuals who practiced praying, and prayer was treated as a continuous variable based on the number of praying hours. Since only six percent of males did not pray, the contribution of praying as a dichotomous variable could be evaluated only in women. Individuals with missing information on any of the explanatory variables were excluded. All analyses were performed using SAS (Statistical Analysis Software).

Results

Of the 935 eligible individuals approached, 902 agreed to participate in the study (3.5% refusal rate). Eighteen were excluded for the following reasons: recent head trauma ($n = 2$), recent ischemic stroke ($n = 3$), end stage renal failure ($n = 2$), metastatic carcinoma ($n = 2$), systemic disease ($n = 7$) and severe depression ($n = 2$). Eighty-six individuals who had other diagnoses including vascular dementia ($n = 39$) and Parkinson's disease ($n = 13$) or were "not classifiable" ($n = 34$) and 20 individuals with missing data were also excluded from analyses. Among the remaining 778 individuals, 448 were classified as cognitively normal, 238 as MCI, and 92 as AD. The study population is shown in Fig. (1). Characteristics of these groups are shown in Table 1.

Women were significantly less educated than men (mean school year $\pm$ SD: 1.03 ± 2.15 women vs. 4.54 ± 3.56 men; $p < 0.0001$). Cognitively normal individuals had more years of schooling than individuals with MCI or AD (Table 1). We found a significant relationship between midlife praying and the risk of MCI and AD versus controls. The proportion of individuals praying at midlife was significantly higher among controls (87%) as compared to MCI (71%) and AD (69%); $\chi^2 = 28.60$, $p < 0.0001$). The proportion that prayed during midlife was 94% for men and 66% for women. Since only six percent of males did not pray, the contribution of praying as a dichotomous variable could be evaluated only in women. Among women, 74% of controls, 60% of MCI and 60% of AD prayed during midlife.

Stepwise logistic models were used to estimate the odds of AD or MCI vs. normal controls as a function of age, school years, praying and their mutual interactions. Stepwise logistic regression analysis of female MCI ($n = 136$) patients versus female CN ($n = 166$) showed a significant effect of praying [$p = 0.027$, OR = 0.55 (95% CI 0.33 - 0.94)], age [$p = 0.0054$, OR = 1.06 (95% CI 1.02 - 1.11)] and school years [$p < 0.0001$, OR = 0.67 (95% CI 0.56 - 0.79)]. The number of praying hours for those who prayed did not significantly influence the risk of MCI in any gender. Stepwise logistic regression analysis of female AD ($n = 56$) patients versus CN ($n = 166$) showed a significant effect age [$p < 0.0001$, OR = 1.16 (95% CI 1.10 - 1.23)] and school years [$p = 0.0046$, OR = 0.70 (95% CI 0.54 - 0.89)]. Neither praying nor the number of praying hours in those who prayed influenced the risk of AD in any gender (Table 2).

Discussion

We found that praying at midlife is accompanied by a lower risk of mild cognitive impairment in Arabic women from Wadi Ara.

In order to discuss the effect of prayer on cognitive decline one needs to define the "neurological significance" of praying. Prayer can be classified as a leisure activity or as a repetitive and/or mentally enhancing activity whose ritual includes both cognitive and motor components. It is also necessary to consider the spiritual and religious aspects of prayer. Concerning the effect of leisure activities, a prospective, 21-year study demonstrated a significantly decreased risk of dementia (both AD and VD) associated with a higher level of participation in leisure activities at baseline [34]. Participation in an activity for one day per week was associated with a reduction of 7% in the risk of dementia. The association

between cognitive activities and the risk of dementia remained robust even after adjustment for potential confounding variables such as age, sex and educational level. Several possible explanations can be proposed for the association between greater participation in leisure activities and a decreased risk of dementia. First, the presence of preclinical dementia may decrease participation in leisure activities. One study reported that an accelerated decline in memory begins seven years before dementia is diagnosed [35]. In our cohort with a mean present age of 72.5 (± 6.5) years we focused on leisure activities at younger ages at midlife. This suggests that prayer activity is a modifying factor rather than a consequence of preclinical dementia. Unmeasured confounding variables such as premorbid intelligence may also influence the results. There may be a true causal effect of prayer as a repetitive cognitive activity. Results from the linear mixed models that analyzed cognitive function over time corroborate the findings of previous studies [36, 37], and show that increased participation in cognitive activities is associated with slower rates of cognitive decline, especially in terms of episodic memory.

The observed association between prayer and decreased risk for MCI appears to be independent of educational level, which may influence the choice or the capability to learn and recite prayer. We have previously shown in this cohort that education is protective for cognitive decline [38].

Praying was not significantly associated with risk of AD. The reason for this may be due to smaller sample of AD cases, or inherent to the nature of the distinction between MCI and AD. AD, unlike MCI, has distinct neuropathological presentations and development. It is possible that while praying affects cognitive decline in a complex behavioral manner, it has no effect on the development of the AD-specific pathological markers.

Our findings cannot prove a causal relation between participation in prayer and lower risk of cognitive decline. It can at best generate hypotheses. If there is a causal role, participation in prayer activities may increase cognitive reserve, delaying the clinical or pathological onset of dementia [39-41]. Alternatively, participation in cognitive activities might slow the pathological processes of disease during the preclinical phase of dementia. Our findings do not imply that individuals who were less active cognitively increased their risk of dementia. The role of individual leisure activities is not well known, since most studies have used composite measures. In a French cohort, knitting, doing odd jobs, gardening and traveling, reduced the risk of dementia [42]. In the Nun Study, low density of ideas and low levels of grammatical complexity in autobiographies written in early life were associated with low cognitive test scores in later life [43]. Exercise is said to have beneficial effects on the brain by promoting plasticity, increasing the levels of neurotrophic factors in the brain, and enhancing resistance to insults [44]. Muslim prayer also involves physical activity. Although physical activities are clearly important in promoting overall health [45], their protective effect against dementia remains uncertain.

Our study has several limitations. The first limitation relates to the fact that we could not examine enough non-praying men since 94% of men practiced prayer at midlife. We therefore could analyze the effect of prayer only in women and subsequently, could not determine whether this effect is sex-specific. The second limitation derives from the diagnostic methods. Although standard criteria and well-established procedures were used to make diagnoses, some misclassification is inevitable. We assume that the misdiagnoses were both in the direction of cognitively normal individuals diagnosed as MCI or vice versa and AD diagnoses and MCI or vice versa with no bias of more/less severe cognitive classification.

Social status differences may also be a source of error or variance despite the homogeneity of our population. The study participants all lived in the same area under similar social conditions. The fact that almost all men practiced prayer is compatible with this observation. Among women, more religious individuals may be inclined to protect their social status or “family honor” by avoiding admittance of MCI symptoms.

An alternative explanation is that individuals with more conservative (or traditional) values, who may be more sensitive to social stigma, may be prone to overstate their religious practice and understate their cognitive symptoms.

Another limitation is the retrospective nature of data collection from cognitively impaired individuals which might have led to errors. Although we validated the information with informants, still errors are inevitable. Retrospective falsification might also have occurred.

Time spent in each prayer session activity was not always available although the history was verified by family members or other informants. Duration and cognitive demand are both important in the assessment of an activity. It is difficult to assign weights to the cognitive demands of leisure activities, since such demands vary among activities and among the persons who engage in each activity. The reduction in the risk of AD and VD by participation in leisure activities is associated with the frequency of participation. For example, elderly persons who did crossword puzzles four days a week (four activity-days) had a risk of dementia that was 47% lower than that among individuals who did puzzles once a week (one activity-day) [34]. In our study we found an effect of prayer as a dichotomous variable but not a “dose-response” effect. Theoretically, alternative ways in which those individuals who did not pray spent their time could increase the risk of disease. This information was not collected in the present study. We also did not consider historical events during mid-life such as wars which might be a life-changing experience.

Clinical trials are needed to define the role of participation in leisure activities. A recent study reported reduced cognitive declines after cognitive training in elderly persons without dementia [37]. If confirmed, our results may support recommendations for participation in cognitive activities to lower the risk of cognitive decline that parallel current recommendations for participation in physical activities to reduce the risk of cardiovascular diseases [45, 46]. If we consider prayer as a leisure activity, our results are corroborated by similar findings in several cohorts [34, 36, 47].

Prayer may act at various stages on this pathway including before memory decline starts, during preclinical stages of dementia where some individuals may meet MCI criteria, or following dementia. As been shown in two prospective observational studies, religiosity [48, 49], or leisure activities [44, 50] might slow down pathological disease progresses of AD.

Conclusion

Our findings suggest that prayer during midlife is associated with a lower risk of developing MCI.

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Fig. (1).
Study population and cognitive classification.

Table 1
Participant Characteristics

	Normal	MCI	AD
Number individuals	448	238	92
Age, years, mean $\pm$ SD	71 $\pm$ 6	73 $\pm$ 6	78 $\pm$ 8
Male, n (%)	269 (60%)	92 (39%)	23 (25%)
Praying individuals [*] , n (%)	369 (87%)	157 (71%)	56 (69%)
Praying hours/month [*] , mean $\pm$ SD	15.6 $\pm$ 15.2	13.4 $\pm$ 16.4	9.7 $\pm$ 13.5
School years, mean $\pm$ SD	3.9 $\pm$ 3.6	1.3 $\pm$ 2.5	0.9 $\pm$ 2.0
Individuals without any schooling, n (%)			
Men	40 (15%)	39 (43%)	11 (48%)
Women	109 (61%)	131 (91%)	62 (93%)

^{*} Values determined as praying activity at midlife.

Table 2
Prayer and Cognitive Decline, Model Summary

Men	Model	Variable	Normal n = 269	p-value ³	MCI OR (95% CI)	p-value ³	AD OR (95% CI)
Praying Yes/No/ Not analyzed		Age, years, mean ± SD	71.2 ± 5.7		74.2 ± 7.0		82.0 ± 8.9
		School years, mean ± SD	5.2 ± 3.5		2.7 ± 3.1		2.4 ± 2.9
		Praying individuals, n (%)	245 (95%)		75 (90%)		20 (95%)
		Age, years, mean ± SD	70.2 ± 5.0	0.0019	73.2 ± 6.6 1.09 (1.03 - 1.15)	<.0001	79.9 ± 8.7 1.26 (1.14 - 1.41)
		School years, mean ± SD	4.9 ± 3.4	0.0032	3.2 ± 3.4 0.86 (0.78 - 0.95)	>.1	2.5 ± 3.6 -----
Praying hours ² > 0		Praying hours, mean ± SD	20.8 ± 15.6	>.1	25.4 ± 15.6 -----	>.1	27.5 ± 15.6 -----
		Praying individuals, n	124 (74%)	0.0270	82 (60%) 0.55 (0.33 - 0.94)	>.1	36 (60%) -----
		Age, years, mean ± SD	67.7 ± 4.3	0.0014	71.2 ± 5.0 1.17 (1.06 - 1.29)	0.0004	76.4 ± 7.6 1.29 (1.12 - 1.49)
		School years, mean ± SD	1.6 ± 2.5	0.0156	0.5 ± 1.9 0.72 (0.55 - 0.94)	0.0323	0.3 ± 1.2 0.46 (0.21 - 0.94)
		Praying hours, mean ± SD	15.9 ± 10.0	>.1	15.9 ± 15.2 -----	>.1	11.3 ± 7.2 -----
Women							
Praying Yes/No/ Not analyzed		Age, years, mean ± SD	70.6 ± 5.4	0.0054	72.5 ± 5.9 1.06 (1.02 - 1.11)	<.0001	77.2 ± 6.9 1.16 (1.10 - 1.23)
		School years, mean ± SD	1.8 ± 2.6	<.0001	0.4 ± 1.3 0.67 (0.56 - 0.79)	0.0046	0.3 ± 1.3 0.70 (0.54 - 0.89)
		Praying individuals, n	124 (74%)	0.0270	82 (60%) 0.55 (0.33 - 0.94)	>.1	36 (60%) -----
		Age, years, mean ± SD	67.7 ± 4.3	0.0014	71.2 ± 5.0 1.17 (1.06 - 1.29)	0.0004	76.4 ± 7.6 1.29 (1.12 - 1.49)
		School years, mean ± SD	1.6 ± 2.5	0.0156	0.5 ± 1.9 0.72 (0.55 - 0.94)	0.0323	0.3 ± 1.2 0.46 (0.21 - 0.94)
Praying hours ² > 0		Praying hours, mean ± SD	15.9 ± 10.0	>.1	15.9 ± 15.2 -----	>.1	11.3 ± 7.2 -----

¹ Praying at midlife as dichotomous variable (Yes/No)

² Praying at midlife as continuous variable (hours per month)

³ As calculated by the stepwise logistic regression model, compared to cognitively normal individuals. Statistically significant values are shown in bold in the Table