



Sleep Quality is Associated with Perceived Memory Performance in Females with Osteoarthritis: A Population-based Cross-sectional Study



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Background

- Osteoarthritis (OA) is associated with increased risks of dementia.
- Both OA and dementia disproportionately affect females.
- Cognitive health is affected by an interplay of lifestyle, metabolic, and biological factors; however, current research focuses mainly on single factor categories.

Objective

To assess the roles of behavioral risk factors, metabolic factors, and age at menopause in perceived memory performance among females with and without OA.

Methods

Study Design:

- Cross-sectional self-report survey in February – October 2022.
- Random population sample (age ≥19 years) with OA (n=2000) and non-OA controls (n=3000), selected from British Columbia’s administrative health databases.
- OA defined by physician billing ICD9/10 codes

Outcome:

- **Everyday Memory Questionnaire (EMQ-13)**; 0-52 points; higher scores = worse memory problems)
- Primary outcome = natural log of sum of 13 EMQ items (lnEMQsum)
- Natural log transformation to normalize residuals in the linear regression models

Variables:

- Sex, age, ethnicity, marital status, education level, income level
- Health behaviors (smoking, alcohol use, physical activity, sleep quality)
- Social support, age at menopause, mood, comorbidities
- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

Analyses:

- Linear regression analysis to analyze the natural log of EMQ-13 scores [ln(1) to ln(53)] according to the levels of behavioral, metabolic, and hormonal risk factors, controlling for WOMAC, demographics, comorbidities for the OA and no-OA groups
- Model selection to select important variables based on adjusted R-squared

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Results

333 female participants
of whom **199** had OA, and **134** did not have OA

M_{age} = 67.3 (SD 13.9)
[OA: 71.7 (10.7), no OA: 61.7 (16.0); p<0.001]

87% were of white ethnicity

Among all participants: **The mean EMQ-13 score: 9.8 (SD 10.3)** [OA: 9.9 (11.0); no-OA: 9.7 (9.2)]

12% reported ‘very good’ sleep quality
57% walked >41mins/day in the last 7 days
32% used alcohol at least 2-3x per week
6% smoked
21% reported depression
16% reported anxiety
60% had menopause at age 54 or under

Table 1. General Linear Models Predicting ln(EMQ score+1) in Females with OA [Coefficient (95% CI)]

| Predictor | Univariable | Fully adjusted | Selected model* |
|------------------------|-----------------------|----------------------|-------------------------|
| Age (every 10 years) | -0.06 (-0.17,0.06); | 0.02 (-0.12,0.16) | n/s |
| White ethnicity | -0.14 (-0.54,0.27) | -0.07 (-0.51,0.38) | n/s |
| Living with others | 0.16 (-0.10,0.41) | 0.27 (-0.04,0.57) | 0.19 (-0.06,0.43) |
| Education level | -0.03 (-0.10,0.03) | -0.03 (-0.10,0.04) | n/s |
| Income level | 0.00 (-0.07,0.07) | 0.02 (-0.06,0.10) | n/s |
| High blood pressure | 0.08 (-0.18,0.34) | -0.07 (-0.34,0.21) | n/s |
| High cholesterol | 0.13 (-0.16,0.43) | 0.19 (-0.13,0.51) | 0.24 (-0.05,0.52) |
| Stroke | 0.92 (0.13,1.70) | 0.17 (-0.85,1.18) | n/s |
| Alzheimer’s / dementia | 1.67 (-0.08,3.42) | 1.71 (-0.28,3.70) | 1.63 (-0.01,3.27) |
| Depression | 0.27 (-0.02,0.57) | 0.33 (-0.01,0.67) | 0.28 (-0.04,0.59) |
| Anxiety | 0.44 (0.12,0.76) | 0.21 (-0.19,0.61) | 0.26 (-0.09,0.60) |
| Smoking current† | 0.48 (-0.19,1.15) | 0.45 (-0.29,1.19) | 0.28 (-0.06,0.61) |
| Alcohol past year | -0.01 (-0.06,0.05) | 0.02 (-0.04,0.08) | -0.31 (-0.70,0.08) |
| Age at menopause | | | |
| 54 or younger | 0.093 (-0.272,0.459) | 0.076 (-0.308,0.461) | n/s |
| 55 or older | -0.168 (-0.593,0.257) | -0.08 (-0.524,0.363) | n/s |
| Not applicable | 1.0 (ref) | 1.0 (ref) | |
| Count close friends | | | |
| 1 | 0.02 (-0.52,0.56) | 0.03 (-0.55,0.60) | |
| 2 | 0.13 (-0.38,0.64) | 0.245 (-0.31,0.80) | |
| 3-4 | -0.13 (-0.67,0.36) | 0.129 (-0.43,0.69) | n/s |
| 5-8 | -0.20 (-0.77,0.36) | 0.091 (-0.54,0.72) | |
| 9+ | -0.73 (-1.37, -0.09) | -0.519 (-1.20,0.16) | |
| 0 | 1.0 (ref) | 1.0 (ref) | |
| Sleep Quality | | | |
| Fairly good | 0.38 (-0.01,0.77) | 0.31 (-0.11,0.75) | 0.42 (0.04,0.80) |
| Fairly bad | 0.49 (0.07,0.91) | 0.434 (-0.03,0.90) | 0.53 (0.12,0.95) |
| Very bad | 1.26 (0.69,1.83) | 0.901 (0.22,1.59) | 1.22 (0.64,1.80) |
| Very good | 1.0 (ref) | 1.0 (ref) | 1.0 (ref) |
| Daily walking time | | | |
| 41mins – 2 hrs | -0.29 (-0.56, -0.017) | -0.24 (-0.53,0.05) | n/s |
| > 2 hours | -0.09 (-0.46,0.27) | -0.13 (-0.53,0.27) | n/s |
| None – 40 min | 1.0 (ref) | 1.0 (ref) | |

Table 2. General Linear Models Predicting ln(EMQ score+1) in Females with no OA [Coefficient (95% CI)]

| Predictor | Univariable | Fully adjusted | Selected model* |
|------------------------|---------------------|--------------------|-----------------------------|
| Age (every 10 years) | -0.12 (-0.21,-0.03) | -0.10 (-0.24,0.05) | -0.10 (-0.19,-0.003) |
| White ethnicity | -0.13 (-0.61,0.34) | -0.09 (-0.69,0.51) | n/s |
| Living with others | -0.15 (-0.47,0.17) | -0.21 (-0.62,0.20) | n/s |
| Education level | 0.01 (-0.07,0.08) | -0.05 (-0.16,0.06) | n/s |
| Income level | -0.003 (-0.09,0.08) | 0.08 (-0.04,0.21) | n/s |
| High blood pressure | 0.09 (-0.26,0.43) | 0.24 (-0.24,0.71) | n/s |
| High cholesterol | -0.03 (-0.43,0.37) | 0.04 (-0.49,0.56) | n/s |
| Stroke | 0.67 (-0.11,1.45) | 0.53 (-0.57,1.63) | n/s |
| Alzheimer’s / dementia | - | - | n/s |
| Depression | 0.22 (-0.16,0.60) | 0.12 (-0.49,0.73) | n/s |
| Anxiety | 0.52 (0.12,0.92) | 0.20 (-0.52,0.91) | 0.41 (0.004,0.82) |
| Smoking current† | -0.07 (-0.70,0.56) | -0.21 (-0.97,0.55) | n/s |
| Alcohol past year | 0.02 (-0.05,0.08) | 0.03 (-0.05,0.11) | n/s |
| Age at menopause | | | |
| 54 or younger | -0.45 (-0.79,-0.11) | -0.32 (-0.86,0.23) | n/s |
| 55 or older | -0.53 (-0.96,-0.09) | -0.26 (-0.90,0.38) | n/s |
| Not applicable | 1.0 (ref) | 1.0 (ref) | |
| Count close friends | | | |
| 1 | 0.06 (-0.58,0.70) | 0.07 (-0.76,0.90) | |
| 2 | 0.17 (-0.42,0.76) | 0.24 (-0.52,1.00) | |
| 3-4 | 0.04 (-0.53,0.60) | 0.23 (-0.50,1.00) | n/s |
| 5-8 | 0.01 (-0.66,0.67) | 0.345 (-0.54,1.22) | |
| 9+ | -0.23 (-1.03,0.57) | 0.03 (-0.97,1.03) | |
| 0 | 1.0 (ref) | 1.0 (ref) | |
| Sleep Quality | | | |
| Fairly good | -0.22 (-0.67,0.24) | -0.38 (-0.91,0.15) | |
| Fairly bad | -0.09 (-0.59,0.42) | -0.28 (-0.86,0.29) | n/s |
| Very bad | 0.32 (-0.50,1.13) | 0.17 (-0.83,1.17) | |
| Very good | 1.0 (ref) | 1.0 (ref) | |
| Daily walking time | | | |
| 41 mins – 2 hrs | -0.15 (-0.49,0.19) | -0.02 (-0.42,0.38) | n/s |
| > 2 hours | -0.10 (-0.50,0.30) | -0.12 (-0.60,0.37) | n/s |
| None – 40 mins | 1.0 (ref) | 1.0 (ref) | |

- Among females with OA, perceived memory problems were associated with poor sleep quality
- Compared to the highest level of sleep quality, stronger effects were observed with each level of lower sleep quality
- For the no-OA group (significantly younger than the OA counterpart), poor memory was associated with age and anxiety

Conclusion

- Sleep quality was a significant independent predictor for memory problems in females with OA
- This highlights the critical role of sleep in cognitive health for this population.
- Future research should explore interventions that improve sleep quality as a potential strategy to enhance brain health in females with OA

