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Gender differences in cognitive performance and health status in the Faroese Septuagenarians cohort

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The aim was to determine cognitive performance and health status in the Faroese Septuagenarians cohort in relation to gender differences. In this cross-sectional study of 713 Faroese septuagenarians who underwent a clinical, neurophysiological and neuropsychological examinations and questionnaire, women performed better on tests covering the memory domain, while there was no gender difference in other cognitive domains. Men suffered more frequently from cardiovascular events while women more frequently suffered from arthrosis, hypothyroidism, and muscle pain. We observed a considerable heterogeneity and gender difference in some cognitive domains and health in Faroese septuagenarians.

Keywords: Septuagenarians; health status; neuropsychological performance; gender difference; Faroe Islands.
Introduction

The Faroe Islands constitute a North Atlantic fishing community with a population of 50,000 inhabitants that has a Scandinavian style health care system. Fishing has been the main source of income since the late 19th century. However, it only accounts for around 15% of the occupations while trades service accounts for 70%(1). The Faroese population have elevated exposure levels of environmental toxicants, e.g. polychlorinated biphenyls and mercury through the tradition of eating pilot whales that are high in the food chain and accumulate these substances(2).

Worldwide, the elderly population consists of a heterogeneous group of individuals with great variation in cognition and health, with some differences between the two genders(3). Although 14% of the Faroese population is older than 67 years, the current knowledge regarding cognitive status and health in this population segment is lacking. Thus, the aim was to determine the cognitive performance and health status of the Faroese Septuagenarians cohort in relation to gender differences.

Methods

In this population-based study all 1131 Faroese citizens born between January 1934 and August 1937 were invited to participate; 713 people agreed to participated (63%). No exclusion criteria were used(4). The subjects underwent clinical, neuropsychological and neurophysiological examinations and a blood sample was collected.

Cognitive function was assessed by a neuropsychological test battery. Language comprehension was assessed by the Boston Naming Test (BNT), a visual confrontation naming test measuring the word retrieval or word finding performance of a subject. Raven’s Coloured Progressive Matrices is a non-verbal reasoning test adapted for elderly people. Neurobehavioral Evaluation System 2 (NES2), Pattern Recognition assesses visuospatial skills. Warrington’s Recognition Memory for Faces (series B) measures visuoperceptual and visuospatial memory. Attention was assessed with NES2 Continuous Performance Test and NES2 Symbol
Digit Modalities Test. Verbal memory was assessed with Word list learning with selective reminding. Motor function was measured with NES2 Finger Tapping test and with Purdue Pegboard test.

Weight, height, waist and hip circumference were measured as was blood pressure. Visual function was assessed by the Snellen card. The clinical measurements were done by the medical doctors using standardised methods. An electrocardiogram (ECG) was recorded and ultrasound measurement of the intima-media thickness (IMT) and plaque was measured(5). A self-administered questionnaire was administered to collect information on variables including sociodemographic information, current and past health history, medication as well as occupational and lifetime exposures. Birth weight and length were obtained from midwife charts.

The study protocol was approved by the Faroese ethical committee and the Institutional Review Board at the U.S. institution.

Statistics

Results are expressed as frequencies, as mean and standard deviation (SD) or median and interquartile range (25–75%) and frequencies. To test for gender differences, categorical variables were analysed by the chi square test and continuous variables by the Mann-Whitney test.

For the neuropsychological outcomes, Z-scores were used to compare individuals to a standard normal deviate: a z-score >1.5 indicating a score above normal, a z-score between 1.5 and -1.5 as normal and a z-score <-1.5 as below normal. Association between self-rated cognition and neuropsychological performance in memory assessing tests was tested with the Mann-Whitney test test.

The analyses were performed using SPSS22.0. A value of P< 0.05 indicated statistical significance.
Results

A total of 713 subjects, 361 men and 352 women, participated at a median age of 72.7 years. The gender and age-distribution of non-participants were similar to the participants (p=0.31, p=0.22).

In most neuropsychological tests the scores span a wide range indicating heterogeneous cognitive capacity among the septuagenarians with a clear gender difference in some domains (table 1). In the memory categories, both with immediate, incidental and delayed memory women performed significantly better. Ten percent of the septuagenarians expressed that their memory is worse than expected for their age; testing self-rated memory against the memory test performance showed significant association for all: selective reminding(p=0.001), face recognition memory test, immediate(p=0.02), BNT, delayed recall(p<0.0001), selective reminding, delayed recall(p<0.0001) and face recognition memory test, delayed recall(p=0.047). In the motor tests, men performed significantly better on the Finger Tapping test while females did better on the Purdue Pegboard test.

Hypertension was the most commonly reported disorder(64.5%), followed by arthrosis(32%), hypercholesterolemia(30%) and cardiovascular disease(22%). Self-reported cardiovascular events, elevated mean IMT, higher prevalence of abnormal ECG and more frequent occurrence of plaques and gout occurred among males. In contrast, self-reported arthrosis, muscle pain and hypothyroidism were significantly more prevalent among females, who also exhibited higher serum concentrations of total lipids. Other self-reported chronic diseases did not differ by gender, nor by medication use or morbidity (supplementary table 1).

Discussion

We found that women performed significantly better on the memory tests and attained better results on tasks of perceptual speed and immediate, incidental and delayed recall, while men performed better on verbal comprehension and spatial attention. These results are in line with a Danish study where women tended to have higher immediate recall scores, as compared with men(6). Other studies have
found a similar tendency with women generally attaining better results than men on tasks of perceptual speed and verbal fluency whereas men tended to perform better on tasks related to visuospatial skills, mathematical reasoning and spatial cognition(7).

A meta-analysis suggests that the correlation between subjective and objective memory is inconsistent, with some studies reporting significant association and others reporting no clear association(8). Our study adds to the evidence of an association between subjective and objective memory as we find a clear association between the neuropsychological tests of memory and self-rated cognition among the Faroese septuagenarians. However, despite a significant difference in performance between the genders in this domain, a similar percentages of the women and men rated their memory worse than expected for age, thus indicating a disconnection between how the Faroese women perceive their memory performance and how they actually perform. This is also in accordance with a meta-analysis that suggests that elderly adults vary in their ability to make accurate judgments about their memory ability(8).

The observed gender differences in health conditions, e.g. higher occurrence of cardiovascular events in men and higher occurrence of self-reported arthrosis among women is in accordance with other studies(9). Since joint diseases such as arthritis and muscle pain are not major causes of mortality, those ailments may be more prevalent among women because they live longer. This is especially true in the Faroes where the life expectancy for women is 5 years longer than for men(1). However, despite gender differences in health outcomes, there were no differences in the self-related health ratings between the genders. Participation rates at enrolment were similar for men and women; therefore this is unlikely to explain the general gender differences observed.

Major strengths of this study are the high participation rate within a narrow age range, the detailed cognitive battery covering a wide range of domains and the usage of standard procedures. Still, both healthy participation bias and survivor bias may be potential concerns. Therefore our results may not necessarily reflect the general health state of the septuagenarians in the Faroes but may overestimate the general health and cognitive performance among Faroese citizens in this age range.
In conclusion, we observed a considerable heterogeneity and gender difference in some cognitive domains and health in Faroese septuagenarians. A 10-year follow-up is ongoing enabling examination of health trajectories and cognition as the cohort ages.

Acknowledgments

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Conflict of interest

None declared

Key points

- Faroese septuagenarians are a heterogenic group with marked differences in health and cognitive performance
- Subjective memory assessment correlated with memory test results
- Women performed better on tests covering the memory domain, while men performed better on verbal comprehension and spatial attention
- Gender difference was observed in some health parameters
- A 10-year follow-up is ongoing enabling examination of health trajectories and cognition as the cohort ages
References

Table 1. Neuropsychological test scores of the Faroese Septuagenarian cohort at age 70-74 years, stratified by gender.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Neuropsychological test</th>
<th>Men (n=361)</th>
<th>Z scores % below/above average</th>
<th>Women (n=352)</th>
<th>Z scores % below/above average</th>
<th>P-value *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal comprehension</td>
<td>Boston Naming Test, no Cues</td>
<td>17.7 (5.7)</td>
<td>5.6/8.1</td>
<td>16.2 (5.8)</td>
<td>8.8/5.4</td>
<td>0.02</td>
</tr>
<tr>
<td>Non-verbal reasoning</td>
<td>Raven Colored Progressive Matrices</td>
<td>17.3 (3.0)</td>
<td>5/8.4</td>
<td>17.1 (2.8)</td>
<td>4.5/6.8</td>
<td>0.29</td>
</tr>
<tr>
<td>Visuospatial Perception</td>
<td>NES2, Pattern Recognition, Correct</td>
<td>24.3 (1.2)</td>
<td>7.6/0</td>
<td>24.3 (1.2)</td>
<td>9.8/0</td>
<td>0.86</td>
</tr>
<tr>
<td>Perceptual Speed</td>
<td>NES2, Pattern Recognition, time</td>
<td>8.4 (3.5)</td>
<td>0/8.5</td>
<td>7.3 (2.7)</td>
<td>0/3.2</td>
<td>&lt;0.00 1</td>
</tr>
<tr>
<td>Attention, Speed</td>
<td>NES2, Continuous Performance Test with letters</td>
<td>452 (61)</td>
<td>2.8/5.9</td>
<td>468 (71)</td>
<td>1.2/9.8</td>
<td>0.002</td>
</tr>
<tr>
<td>Attention, Speed</td>
<td>NES2, Symbol Digit Modalities Test</td>
<td>5.4 (2.0)</td>
<td>0.6/5.6</td>
<td>5.3 (1.9)</td>
<td>0.3/6.3</td>
<td>0.85</td>
</tr>
<tr>
<td>Speed of processing</td>
<td>Face Recognition Memory Test, Immediate Time</td>
<td>4642 (2327)</td>
<td>0/8.2</td>
<td>4622 (2135)</td>
<td>0/6.3</td>
<td>0.69</td>
</tr>
<tr>
<td>Immediate memory</td>
<td>Selective Reminding, 1. trial, immediate recall</td>
<td>3.9 (1.2)</td>
<td>9.5/8.1</td>
<td>4.3 (1.3)</td>
<td>6.8/17.6</td>
<td>&lt;0.00 1</td>
</tr>
<tr>
<td>Learning and recall</td>
<td>Selective Reminding, Reminders</td>
<td>24.6 (13.8)</td>
<td>0/13.7</td>
<td>18.9 (11.3)</td>
<td>0/5.7</td>
<td>&lt;0.00 1</td>
</tr>
<tr>
<td>Immediate memory</td>
<td>Face Recognition Memory Test, Immediate recall</td>
<td>38.6 (5.4)</td>
<td>9.3/2</td>
<td>40.0 (5.5)</td>
<td>8/5.4</td>
<td>&lt;0.00 1</td>
</tr>
<tr>
<td>Incidental memory, delayed</td>
<td>Boston Naming Test, Delayed</td>
<td>6.5 (3.0)</td>
<td>7.3/2.5</td>
<td>8.6 (3.9)</td>
<td>6/15.1</td>
<td>&lt;0.00 1</td>
</tr>
<tr>
<td>Delayed recall</td>
<td>Selective Reminding, Delayed</td>
<td>8.1 (2.1)</td>
<td>11.5/0</td>
<td>8.8 (1.7)</td>
<td>5.4/0</td>
<td>&lt;0.00 1</td>
</tr>
<tr>
<td>Delayed recall</td>
<td>Face Recognition Memory Test, Delayed</td>
<td>35.9</td>
<td>8.2/6.8</td>
<td>37.1</td>
<td>4.3/8.3</td>
<td>0.002</td>
</tr>
<tr>
<td>Manual motor speed</td>
<td>NES2, Finger Tapping Test, Dominant</td>
<td>73.1</td>
<td>2.8/7.6</td>
<td>63.5</td>
<td>12.1/2</td>
<td>&lt;0.00 1</td>
</tr>
<tr>
<td>Manual motor speed</td>
<td>Purdue Peg Board, Dominant</td>
<td>13.2</td>
<td>9.1/3.1</td>
<td>14.5</td>
<td>2.9/12.6</td>
<td>&lt;0.00 1</td>
</tr>
</tbody>
</table>

Results shown as mean (standard deviation)
Abbreviations: SD=standard deviation; NES2=Neurobehavioral Evaluation System 2; BNT, Boston Naming Test.
*Mann-Whitney test used to test for sex differences.