The protective effect of singing on the aging voices: preliminary evidence

Lottie, Catherine1,2, Rivard, Julie1,2 Thibeault, Mélanie3, and Tremblay, Pascale1,2
1Centre de Recherche de l’Institut Universitaire en Santé Mentale de Québec, 2011 de la Canadienne, Québec City, QC, Canada 2Département de Réadaptation, Faculté de Médecine, Université Laval, Québec City, QC, Canada 3Nuance communications Inc., Montréal, Montréal, Canada

Introduction
The effects of aging on voice production are well documented, including changes in loudness, pitch and voice quality. However, one important and clinically relevant question that remains, concerns the possibility that the aging of voice can be prevented or at least delayed through non-invasive methods. In this study, we examined the potentially protective effect of singing on voice production in a group of 71 healthy non-smoking adults (20-83 years-old) with different singing habits. Finding a positive effect of singing on voice production in aging could have immediate and broad practical applications for the growing population of senior citizens.

Method

Participants

Table 1 Participants' characteristics

<table>
<thead>
<tr>
<th>Group</th>
<th>N (n of men)</th>
<th>Age (in years)</th>
<th>Manual preference</th>
<th>GDS mean ± SD</th>
<th>MoCA mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Young</td>
<td>40 (10)</td>
<td>22 ± 3</td>
<td>17 ± 3</td>
<td>54 ± 20.1</td>
<td>28 ± 7.5</td>
</tr>
<tr>
<td>Middle-aged</td>
<td>26 (5)</td>
<td>45 ± 5</td>
<td>18 ± 3.5</td>
<td>53 ± 2.9</td>
<td>28 ± 5.9</td>
</tr>
<tr>
<td>Older</td>
<td>25 (10)</td>
<td>72 ± 4</td>
<td>19 ± 3.5</td>
<td>51 ± 2.1</td>
<td>27 ± 1.5</td>
</tr>
</tbody>
</table>

Table 2 Singing-based grouping

<table>
<thead>
<tr>
<th>Frequency</th>
<th>N</th>
<th>Mean age ± SD</th>
<th>Mean age ± SD</th>
<th>N</th>
<th>Mean age ± SD</th>
<th>N</th>
<th>Mean age ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>35</td>
<td>51.6 ± 21.3</td>
<td>54.7 ± 19.9</td>
<td>27</td>
<td>54.7 ± 19.9</td>
<td>27</td>
<td>54.7 ± 19.9</td>
</tr>
<tr>
<td>Occasionally</td>
<td>9</td>
<td>37.5 ± 15.9</td>
<td>46.7 ± 14.6</td>
<td>9</td>
<td>46.7 ± 14.6</td>
<td>9</td>
<td>46.7 ± 14.6</td>
</tr>
<tr>
<td>Frequent</td>
<td>11</td>
<td>51.3 ± 7.3</td>
<td>50.7 ± 4.1</td>
<td>15</td>
<td>50.7 ± 4.1</td>
<td>15</td>
<td>50.7 ± 4.1</td>
</tr>
</tbody>
</table>

Procedures

Vowel /a/
For this task, participants produced the vowel /a/ for as long as possible, 5 times, with a short pause between each production. The participants produced the vowel at a "comfortable rate", that is, at a range of pitch not associated with subjective muscular tension or discomfort during phonation. To control for intensity, a digital sound meter was placed 50 cm away from the mouth of the participant. The target intensity was set at 80 ± 2 dB to prevent biases in acoustic measurements of jitter, shimmer, and HNR.

Propositional speech
For this task, participants read a 2-minute standardized passage called « La baie de la pêche » (the wind and the sun). They first read the passage silently and then read it aloud in a natural manner (i.e., no theatrical manner).

Voice recording

Table 1 Participants' characteristics

Results

Table 2 Singing-based grouping

Figure 1 Conceptual moderation model

Figure 2 Main effect of age on voice stability

Figure 3 Effects of age on voice mean f0 in women displayed as a function of age groups

Figure 4 Main effect of age on propositional speech in women

Figure 5 Results of the moderation analyses

Figure 6 Conditional effects of singing frequency on the relationship between age (in years) and voice f0 SD

Figure 7 Conditional effects of singing on the relationship between age (in years) and amplitude SD

Conclusions

As was expected, effects of aging were found on most acoustic parameters with significant sex differences

Importantly, moderation analyses revealed that frequent singing moderates the effect of aging on most acoustic parameters

Specifically, in frequent singers, there was no increase in the variability of f0 and amplitude with age, suggesting that the voice of frequent singers is more stable in aging than that of non-singers, and more generally, providing empirical evidence for a protective role of singing in aging.

Though additional research is needed to guide clinical practice, these results are an important first step to provide evidence that singing exercises could be a low-cost alternative, or a complement, to traditional voice therapy, which could be self-administered at home.

Caption.

Figure 1 Conceptual moderation model used to uncover the moderating effect of singing frequency on the relationship between age and voice acoustics.

Figure 2. Voice f0 SD in women (A) and shimmer in women (B) are displayed as a function of age groups. Asterisks indicate significance at p<0.05. Error bars represent the standard error of the mean.

Figure 3. Effects of age on voice mean f0 in women displayed as a function of age groups. Interactions indicate significance at p<0.05. Error bars represent the standard error of the mean.

Figure 4. Main effect of age on propositional speech in women. F0, f0 SD, shimmer, and shimmer amplitude SD are displayed as a function of age groups. Asterisks indicate significance at p<0.05. Error bars represent the standard error of the mean.

Figure 5. Results of the moderation analyses. Error bars represent the standard error of the mean.

Figure 6. Conditional effects of singing frequency on the relationship between age (in years) and voice f0 SD. The interaction between age and singing frequency (XM) is associated with high f0, low f0 SD, and amplitude SD (b2). The interaction between age and singing frequency (XM) is associated with low high f0, low f0 SD, and amplitude SD (b3). The interaction between age and singing frequency (XM) is associated with high high f0, low f0 SD, and amplitude SD (b4). Finally, there was a conditional effect of singing on the relationship of voice acoustics between frequent singers associated with low f0, low f0 SD, low amplitude, and high f0 SD (b5). As was expected, effects of aging were found on most acoustic parameters with significant sex differences.

Figure 7. Conditional effects of singing on the relationship between age (in years) and amplitude SD. Error bars represent the standard error of the mean.

Conclusions

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