

## 1. Subjects

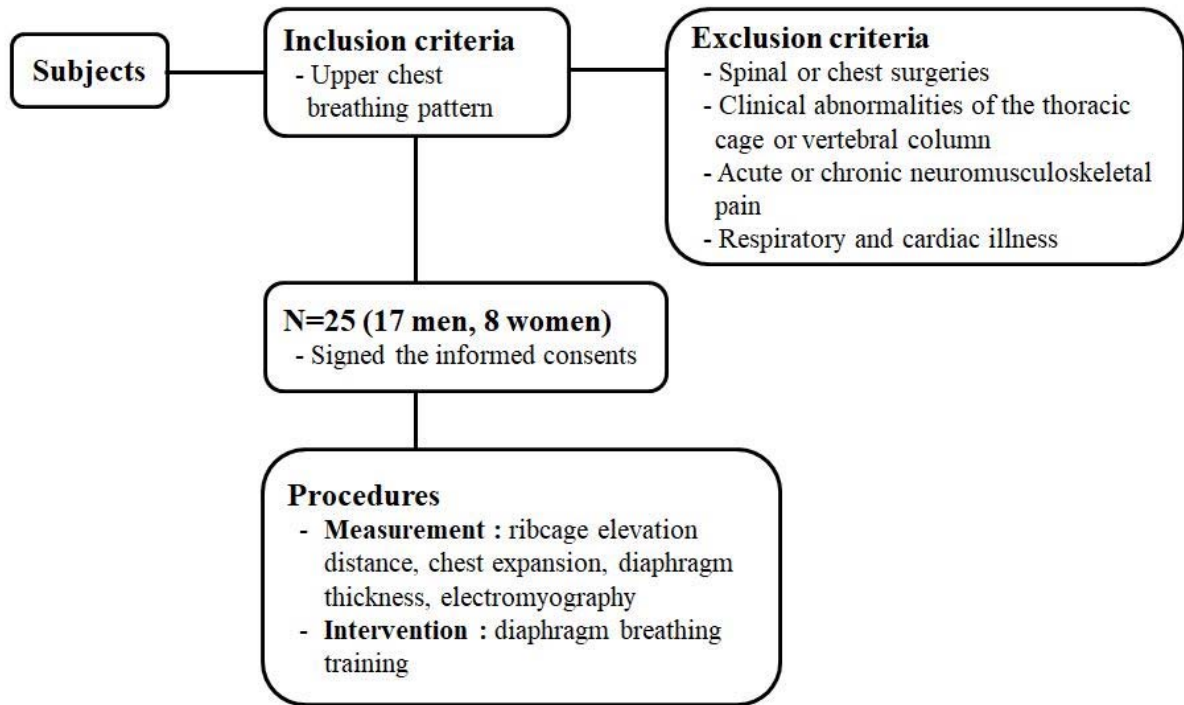


Table 1. Physical characteristics of subjects in the study

(N=25)

|                                      | Mean $\pm$ SD <sup>a</sup> |
|--------------------------------------|----------------------------|
| Age (years)                          | 22.2 $\pm$ 2.2             |
| Height (cm)                          | 171.8 $\pm$ 7.2            |
| Weight (kg)                          | 72.0 $\pm$ 10.6            |
| Body mass index (kg/m <sup>2</sup> ) | 24.0 $\pm$ 2.9             |

<sup>a</sup>SD: Standard Deviation.

# Results

## 1. Reliability of the Ribcage Elevation Distance Index

Table 2. Mean  $\pm$  standard deviation, intra-class correlation coefficient, 95% confidence interval, standard error of measurement, and minimal detectable changes of the ribcage elevation distance index in subjects with upper chest breathing pattern

| Position                       | Type of reliability     |                           | Mean $\pm$ SD <sup>a</sup> | ICC <sup>b</sup><br>(95%CI <sup>c</sup> ) | SEM <sup>d</sup> | MDC <sub>95</sub> <sup>e</sup> |
|--------------------------------|-------------------------|---------------------------|----------------------------|---|------------------|--------------------------------|
| Static                         | Intra-rater reliability | Examiner 1                | 17.47 $\pm$ 0.99           | 0.98<br>(0.96–0.99)                       | 0.14             | 0.39                           |
|                                |                         | Examiner 2                | 17.24 $\pm$ 0.89           | 0.98<br>(0.97–0.99)                       | 0.12             | 0.33                           |
|                                | Inter-rater reliability | Examiner 1 vs. Examiner 2 | 17.36 $\pm$ 0.88           | 0.87<br>(0.71–0.94)                       | 0.31             | 0.86                           |
| The end of maximal inspiration | Intra-rater reliability | Examiner 1                | 18.52 $\pm$ 1.11           | 0.98<br>(0.96–0.99)                       | 0.16             | 0.44                           |
|                                |                         | Examiner 2                | 18.44 $\pm$ 1.03           | 0.98<br>(0.97–0.99)                       | 0.14             | 0.39                           |
|                                | Inter-rater reliability | Examiner 1 vs. Examiner 2 | 18.47 $\pm$ 1.01           | 0.87<br>(0.71–0.94)                       | 0.36             | 0.98                           |
| The end of maximal expiration  | Intra-rater reliability | Examiner 1                | 16.76 $\pm$ 1.07           | 0.98<br>(0.96–0.99)                       | 0.15             | 0.41                           |
|                                |                         | Examiner 2                | 16.73 $\pm$ 0.98           | 0.97<br>(0.95–0.99)                       | 0.17             | 0.47                           |
|                                | Inter-rater reliability | Examiner 1 vs. Examiner 2 | 16.74 $\pm$ 0.94           | 0.80<br>(0.55–0.91)                       | 0.42             | 1.16                           |

<sup>a</sup>SD: Standard Deviation.

<sup>b</sup>ICC: Intraclass Correlation Coefficient.

<sup>c</sup>CI: Confidence Interval.

<sup>d</sup>SEM: Standard Error of Measurement.

<sup>e</sup>MDC<sub>95</sub>: Minimal Detectable Change with 95% Confidence Interval.

## 2. Correlation Between the Ribcage Elevation Distance Index and Diaphragm Thickness

Table 3. Mean  $\pm$  standard deviation of ribcage elevation distance index and diaphragm thickness in subjects with upper chest breathing pattern

|                          | Static position               | The end position of maximal inspiration |
|--------------------------|-------------------------------|---|
| REDI <sup>a</sup> (%)    | 17.47 $\pm$ 0.99 <sup>b</sup> | 18.52 $\pm$ 1.11                        |
| Diaphragm thickness (cm) | 0.15 $\pm$ 0.03               | 0.22 $\pm$ 0.05                         |

<sup>a</sup>REDI: Ribcage Elevation Distance Index.

<sup>b</sup>Mean  $\pm$  Standard Deviation

Table 4. Correlation coefficient value (r) between the ribcage elevation distance index and diaphragm thickness in subjects with upper chest breathing pattern

|                       | Position                       | Diaphragm thickness (cm) |      |
|-----------------------|--------------------------------|--------------------------|------|
|                       |                                | r                        | p    |
| REDI <sup>a</sup> (%) | Static                         | -0.17                    | 0.47 |
|                       | The end of maximal inspiration | -0.13                    | 0.47 |

<sup>a</sup>REDI: Ribcage Elevation Distance Index.

### 3. Comparison of Pre-Post Diaphragm Breathing Training

Table 5. Mean  $\pm$  standard deviation for each variable before and after diaphragm breathing training

|  | Position                       | Diaphragm breathing training  |                  | <i>p</i> |
|--|--------------------------------|-------------------------------|------------------|----------|
|  |                                | Before                        | After            |          |
| REDI <sup>a</sup> (%)                                  | Static                         | 17.47 $\pm$ 0.98 <sup>b</sup> | 17.20 $\pm$ 0.96 | 0.01 *   |
|  | The end of maximal inspiration | 18.52 $\pm$ 1.13              | 17.37 $\pm$ 0.99 | <0.01 *  |
| Chest expansion (cm)                                   | Maximal inspiration            | 97.71 $\pm$ 4.82              | 95.50 $\pm$ 5.30 |          |
|  | Maximal expiration             | 93.47 $\pm$ 5.46              | 93.39 $\pm$ 5.15 |          |
|  | Inspiration-expiration         | 4.31 $\pm$ 1.74               | 2.03 $\pm$ 1.02  | <0.01 *  |
| Diaphragm thickness (cm)                               | Static                         | 0.15 $\pm$ 0.03               | 0.19 $\pm$ 0.03  | <0.01 *  |
|  | The end of maximal inspiration | 0.22 $\pm$ 0.05               | 0.27 $\pm$ 0.06  | <0.01 *  |
| SCM <sup>c</sup> muscle activity (%MVIC <sup>d</sup> ) | Static                         | 3.98 $\pm$ 2.36               | 2.67 $\pm$ 2.07  | <0.01 *  |
|  | The end of maximal inspiration | 4.65 $\pm$ 2.55               | 2.78 $\pm$ 1.77  | <0.01 *  |
| Anterior scalene muscle activity (%MVIC)               | Static                         | 10.72 $\pm$ 7.59              | 7.79 $\pm$ 6.71  | <0.01 *  |
|  | The end of maximal inspiration | 12.48 $\pm$ 8.72              | 8.75 $\pm$ 6.73  | <0.01 *  |

<sup>a</sup>REDI: Ribcage Elevation Distance Index.

<sup>b</sup>Mean  $\pm$  Standard Deviation.

<sup>c</sup>SCM: Sternocleidomastoid

<sup>d</sup>MVIC: Maximal Voluntary Isometric Contraction.

\* *p*<0.05.