# VALIDITY OF MUSCLE SIZE AND QUALITY ANALYSIS TECHNIQUES

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## BACKGROUND

- Muscle anatomical cross-sectional area (ACSA) and echo intensity (EI) can be assessed via Brightness-mode (B-mode) ultrasound
- Manual analysis requires consistent selection of the muscle tissue and avoiding surrounding fascia
- Recently, an automatic software, Deep Anatomical Cross-Sectional Area (DeepACSA), was created to eliminate technician bias and reduce the time required for ultrasound analysis (Ritsche et. al., 2022)

**PURPOSE:** To investigate the validity of manual compared to automatic ultrasound analysis techniques for muscle anatomical cross-sectional area and echo intensity at two frequencies.



**Figure 1.** Graphical user interface (GUI) from the DeepACSA program. Ultrasound image details are entered into the GUI for analysis.

## PRACTICAL APPLICATIONS

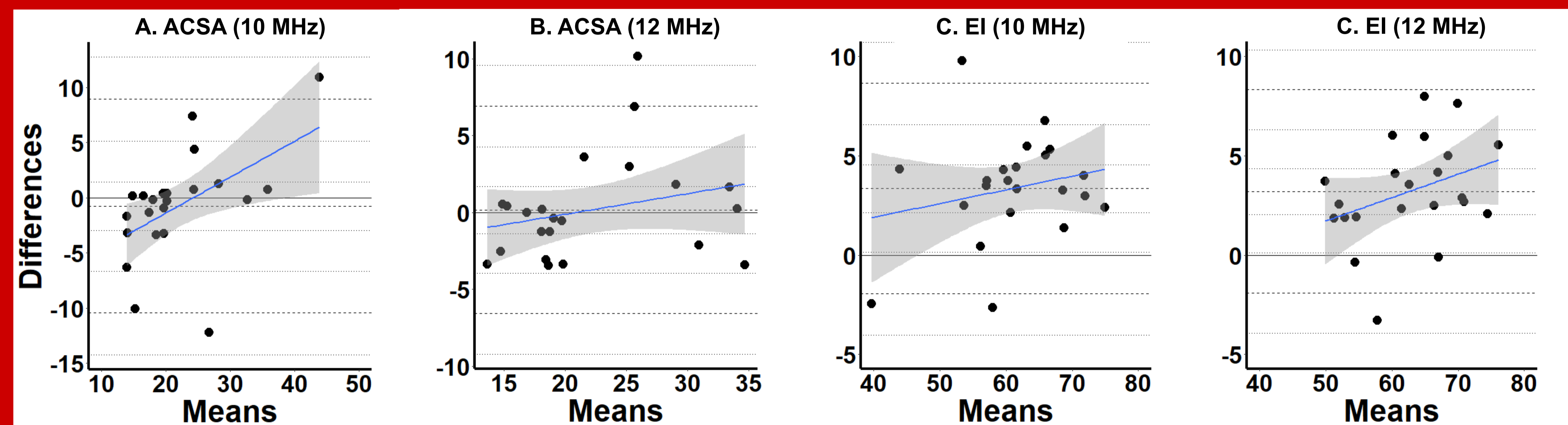### Automatic ultrasound analysis is a *valid tool* for *reducing bias* and *time*



**Figure 2.** The regression lines in the Bland-Altman plots indicate bias for analysis of anatomical cross-sectional area (ACSA) (A. 10 MHz: -0.76, $R^2 = 0.73$; B. 12 MHz: 0.17, $R^2 = 0.78$) and of echo intensity (EI) (C. 10 MHz: 3.35, $R^2 = 0.91$; D. 12 MHz: 3.21, $R^2 = 0.91$).
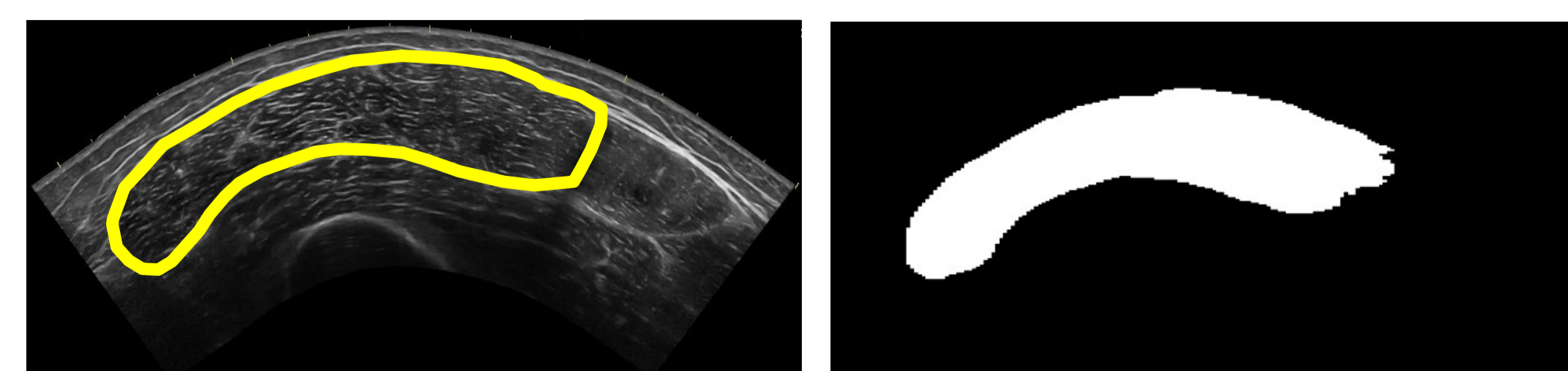
## METHODS

### Ultrasound Assessment
- N = 22; 24 ± 4 yrs; 24.19 ± 3.26 kg/m$^2$



### Ultrasound Analysis
- Manually analyzed using an open-source imaging software, ImageJ
- Automatically analyzed using the DeepACSA program



### Statistical Analysis
- Validity statistics (i.e., constant error [CE], total error [TE], standard error of the estimate [SEE]) were calculated for both the manual and automatic analyses of each ultrasound frequency (10 and 12 MHz)

## RESULTS

- Automatic analyses of ACSA had a greater TE and SEE at a frequency of 10 MHz than at 12 MHz
- Automatic analyses of EI had a greater TE and SEE at a frequency of 10 MHz than at 12 MHz

|         | **Anatomical Cross-Sectional Area** | | | |
|---------|-------|------|------|-------|
|         | **CE** | **TE** | **SEE** | **$R^2$** |
| **10 MHz** | -0.73 | 4.77 | 3.56 | 0.73 |
| **12 MHz** | 0.16 | 3.29 | 3.03 | 0.78 |

|         | **Echo Intensity** | | | |
|---------|-------|------|------|-------|
|         | **CE** | **TE** | **SEE** | **$R^2$** |
| **10 MHz** | 3.21 | 4.17 | 2.52 | 0.91 |
| **12 MHz** | 3.07 | 4.01 | 2.29 | 0.91 |

**Table 1.** Validity statistics for manual compared to automatic ultrasound analyses of anatomical cross-sectional area and echo intensity at high (12 MHz) and low (10 MHz) frequencies.

## CONCLUSION

- This study suggests low CE, TE, and SEE regardless of frequency
- The DeepACSA program may be a promising alternative to manual ultrasound analysis
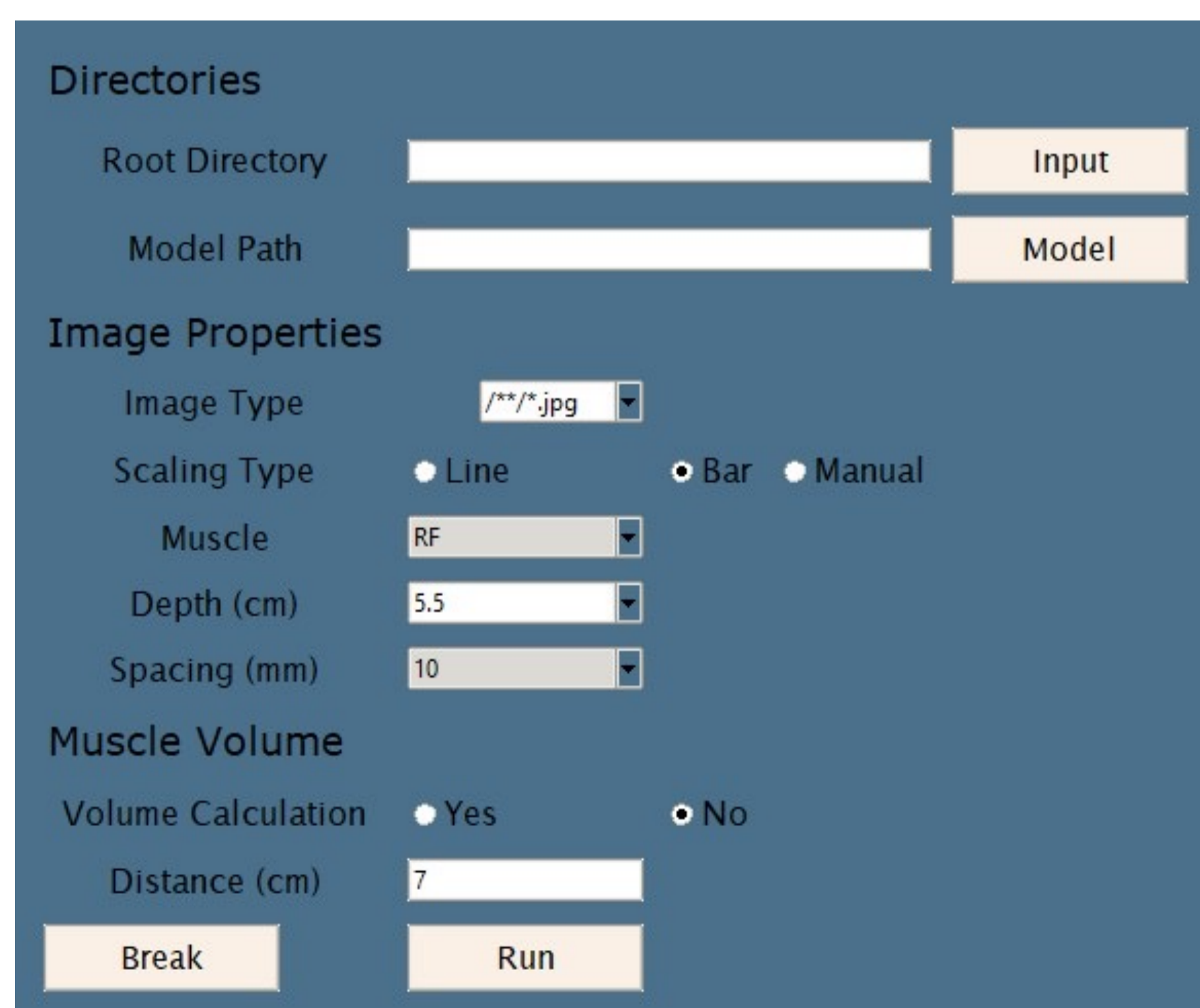- Investigators should use caution when utilizing the program until future studies are completed