

# The Role of Age in the Relationship Between Muscle Morphology and Back Muscle Endurance

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## Summary

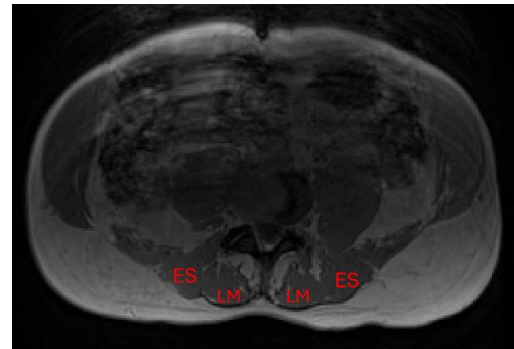
The relationship between lumbar muscle cross-sectional area (CSA) and endurance is not well understood. In the present study, the relationship between CSA of the lumbar musculature and endurance, as quantified by the Biering-Sørensen (BS) test [1], was examined in individuals over the age of 50y. Eighteen participants (13 males, 5 females) were categorized by physical activity status and underwent IDEAL magnetic resonance imaging (MRI) at L4-L5 using a Siemens 3T PrismaFit scanner. Muscle morphology was quantified by manual segmentation in ITK-SNAP. Multiple linear regression revealed that age and physical activity level (HUNT1 score) were significant predictors of BS endurance time, whereas BMI-normalized erector spinae (ES) and lumbar multifidus (LM) CSA was not. These findings provide insight into the role of physical activity and muscle morphology on lumbar endurance capacity in aging individuals.

## Introduction

Decreases in CSA have been associated with age-related declines in strength [3]. However, the CSA relationship to muscle endurance is less clear, particularly for the lumbar spine region [2]. The BS test is commonly used for low back endurance [1]; however, it is not entirely clear how the results of the test relate to CSA and physical activity level. Some studies have examined the relationship between lumbar muscle morphology and lumbar endurance [2,4], but further research can be done in order to illustrate how muscle morphometric changes are impacting endurance throughout aging. The purpose of this study was to examine the relationship between lumbar muscle CSA and muscular endurance in individuals over 50 years old.

## Methods

18 participants (13 males, 5 females) between the ages of 50y and 85y were recruited and classified based on physical activity level. Participants underwent MRI scans at the L4-L5 level using IDEAL imaging on a Siemens 3T PrismaFit MRI scanner (Siemens Healthcare GmbH, Erlangen, Germany). Morphological measures of the ES, and LM were extracted using ITK-SNAP open-source software. A multiple linear regression analysis was conducted to examine the relationship between BS endurance time and Age, HUNT1 score, and ES CSA normalized to BMI (ES/BMI). A second multiple linear regression analysis examined the relationship between BS time and Age, HUNT1 score, and LM CSA normalized to BMI (LM/BMI).



**Figure 1:** Cross sectional DIXON scan at L4/L5 level. Highlighted areas represent fat content

## Results and Discussion

A multiple linear regression analysis examined the relationship between BS time and Age, HUNT1 score, and ES/BMI. The model was statistically significant ( $F(3, 14) = 4.85$ ,  $p = 0.017$ ), explaining 47% ( $R^2 = 0.47$ ) of the variance in BS time. Age ( $\beta = -2.87$ ,  $p = 0.041$ ) and HUNT1 score ( $\beta = 6.95$ ,  $p = 0.012$ ) were significant predictors, whereas ES CSA / BMI ( $\beta = -0.31$ ,  $p = 0.642$ ) was not. A second multiple linear regression analysis examined the relationship between BS time and Age, HUNT1 score, and LM/BMI. The model was also statistically significant ( $F(3, 14) = 6.21$ ,  $p = 0.006$ ), explaining 59% ( $R^2 = 0.59$ ) of the variance in BS time. Age ( $\beta = -3.05$ ,  $p = 0.029$ ) and HUNT1 score ( $\beta = 7.62$ ,  $p = 0.010$ ) were significant predictors, whereas LM CSA / BMI ( $\beta = -0.4512$ ,  $p = 0.621$ ) was not. These findings suggest that Age and HUNT1 influence BS time, while LM and ES CSA do not contribute significantly in a 50y+ population.

## Conclusions

These findings suggest that physical activity is more strongly associated with lumbar endurance capacity in individuals over 50 years old, while muscle morphology plays a lesser role. Future research could explore strategies or interventions to mitigate age-related declines in muscular endurance.

## Acknowledgments

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## References

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