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Association of Weight Cycling with MRI-based Thigh Muscle Quality and Knee-adjacent Obesity: Osteoarthritis Initiative Data

Authors: Adrian A. Marth, MD , Gabby B. Joseph, PhD , Katharina Ziegeler, MD , Virginie Kreutzinger, MD , Felix Liu, MS, John A. Lynch, PhD , Michael C. Nevitt, PhD , Charles E. McCulloch, PhD , Nancy E. Lane, MD , and Thomas M. Link, MD, PhD | AUTHORS INFO & AFFILIATIONS

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Abstract

Background

Repeated episodes of weight loss and regain, termed “weight cycling,” may be associated with sarcopenia.

Purpose

To compare 48-month changes in MRI-based thigh muscle volume, proportion of intermuscular adipose tissue (IMAT), and knee-adjacent subcutaneous adipose tissue (KaSAT) thickness between weight-stable weight cyclers and weight-stable noncyclers.

Materials and Methods

In this secondary analysis of Osteoarthritis Initiative data conducted from February 2004 to October 2015, participants with less than a 5% cumulative weight change from baseline to the 48-month follow-up were classified as weight cyclers or noncyclers based on the root mean square error of individual regression models of annual body mass index measurements. The outcomes included changes in MRI-based thigh muscle volume, proportion of IMAT, and KaSAT thickness of the right thigh and knee between baseline and follow-up. Linear regression models were used to evaluate the associations between weight cycling and the outcomes; the models were adjusted for demographic, anthropometric, metabolic, and lifestyle factors.

Results

A total of 1433 participants were included (mean age, 60.9 years ± 8.9 [SD]; 750 female). Weight cyclers (n = 77) had greater muscle volume loss than noncyclers (n = 1356) (−3.71% [95% CI: −6.08, −1.35] vs −1.03% [95% CI: −2.62, 0.57]; P = .003). There was no evidence of a difference in IMAT proportion change (weight cyclers: 2.55% [95% CI: 0.70, 4.40]; noncyclers: 2.61% [95% CI: 1.36, 3.87]; P = .93) or in KaSAT thickness change (weight cyclers: 12.30% [95% CI: 6.26, 18.30]; noncyclers: 12.20% [95% CI: 8.12, 16.20]; P = .97).

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Conclusion

In participants who maintained stable weight over 48 months, weight cycling was associated with an increased loss of MRI-based thigh muscle volume, whereas no evidence of a difference was found for changes in IMAT proportion. The KaSAT thickness increased in all participants, but there was no evidence of a difference between weight cyclers and noncyclers.

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Supplemental material is available for this article.

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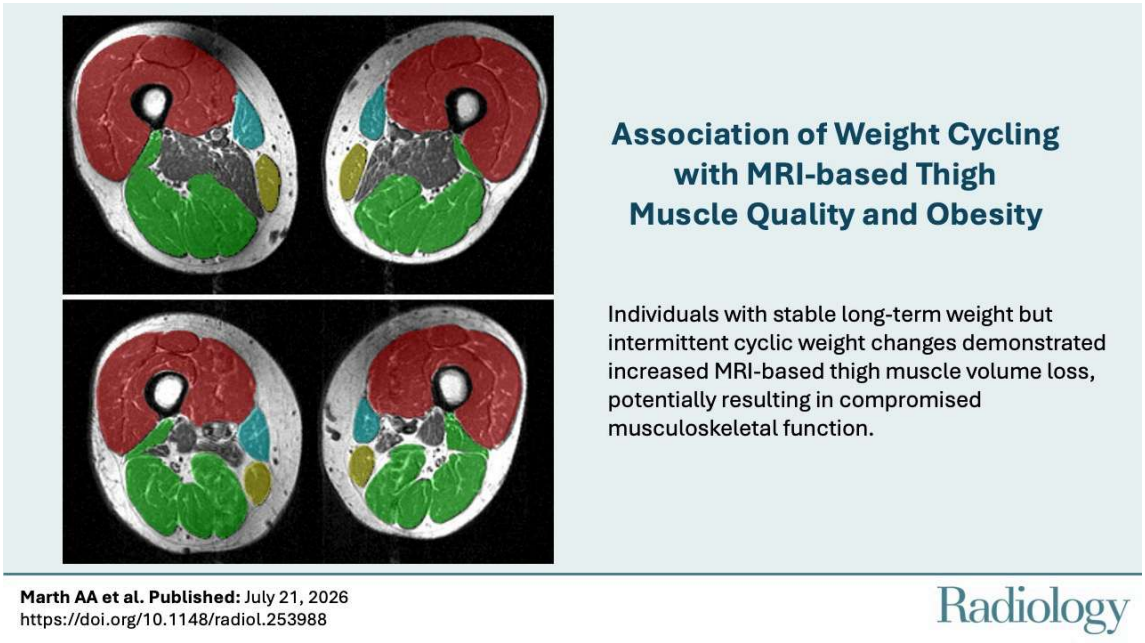
Visual Abstract



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Figures

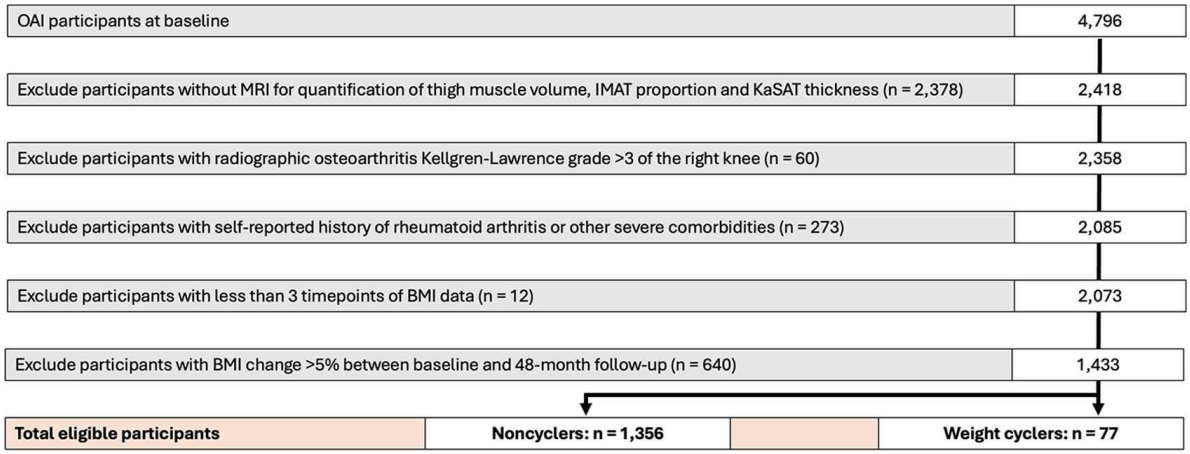

Figure 1: Flowchart shows participant selection process. BMI = body mass index, IMAT = intermuscular adipose tissue, KaSAT = knee-adjacent subcutaneous adipose tissue, OAI = Osteoarthritis Initiative.

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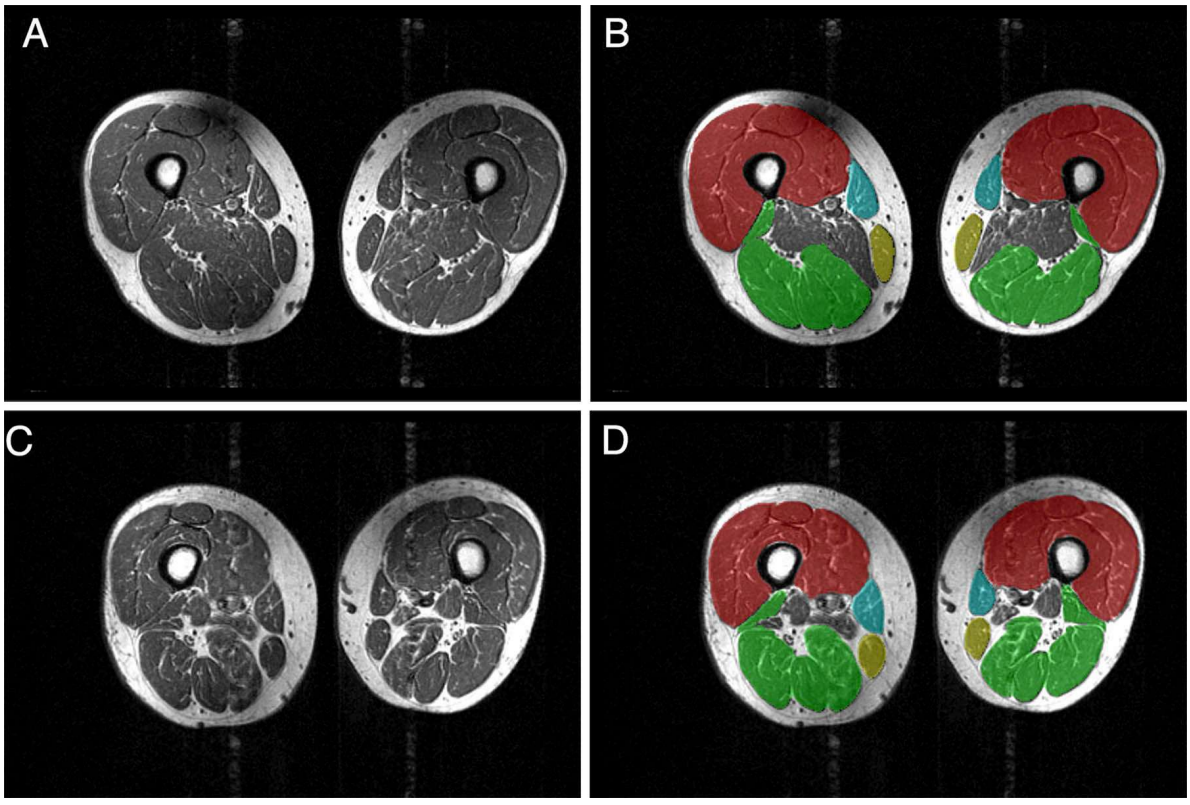

Figure 2: Representative axial noncontrast T1-weighted MRI scans with overlaid masks of the quadriceps (red), hamstrings (green), sartorius (turquoise), and gracilis (yellow) muscles in a 62-year-old male weight cycler at **(A, B)** baseline and **(C, D)** 48-month follow-up. A total decrease in thigh muscle volume of 16% was observed, whereas body mass index decreased by only 1.6%.

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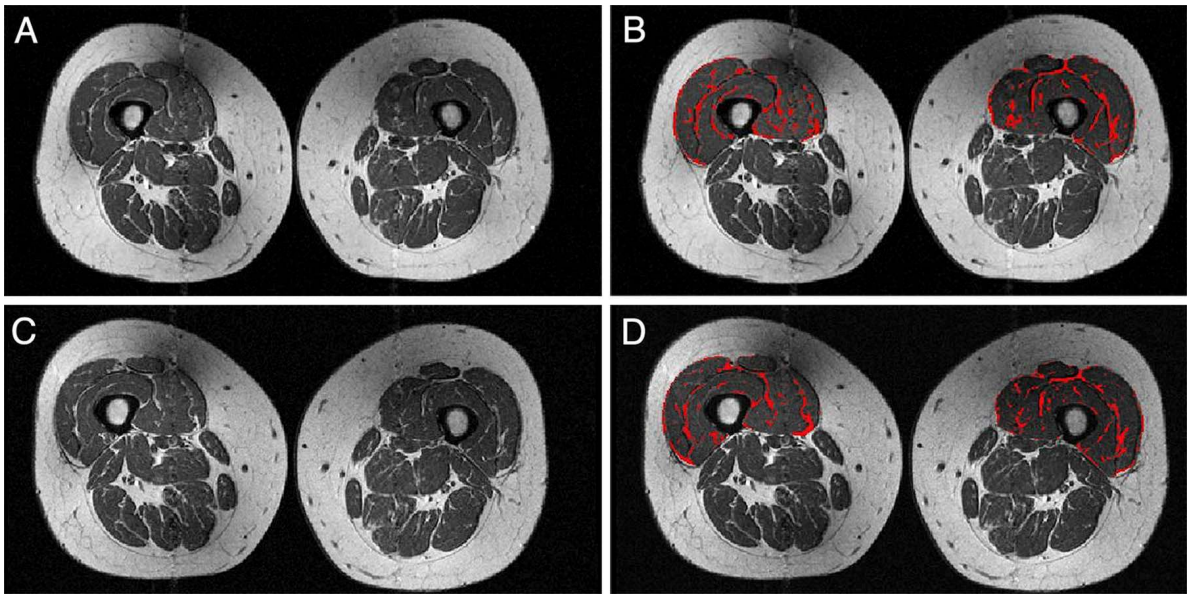

Figure 3: Representative axial noncontrast T1-weighted MRI scans of the mid-thigh in a 51-year-old female weight cycler with red overlaid masks of intermuscular adipose tissue (IMAT) of the quadriceps muscle at **(A, B)** baseline and **(C, D)** 48-month follow-up. IMAT proportion in this participant changed from 10.7% at baseline to 10.9% at follow-up.

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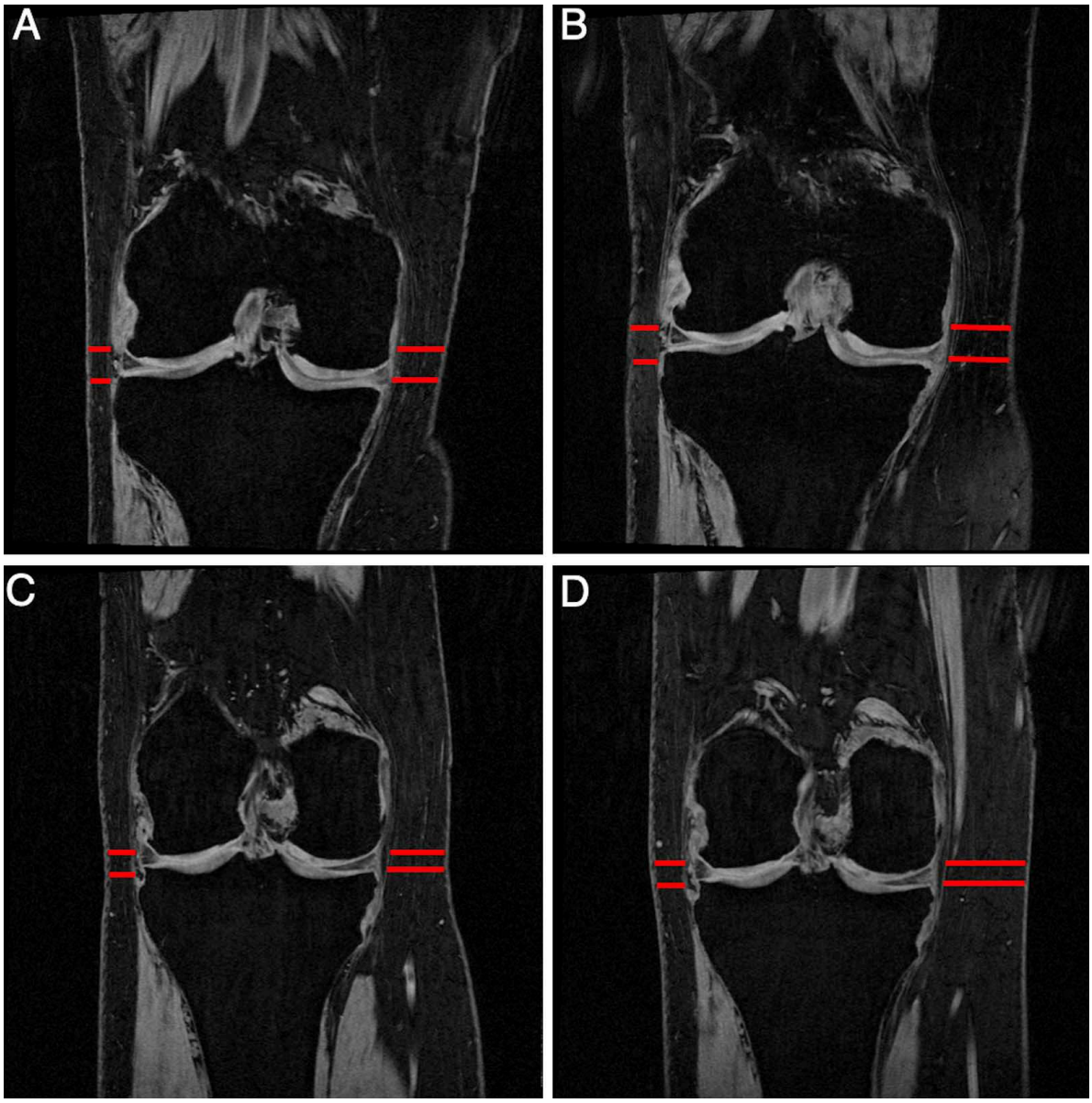

Figure 4: Representative coronal noncontrast T1-weighted fast low-angle shot MRI scans of the knee in a 55-year-old male weight cycler at **(A)** baseline and **(B)** 48-month follow-up, in which an increase in knee-adjacent subcutaneous adipose tissue (KaSAT) thickness of 14% was observed. **(C, D)** Similarly, a 38% increase in KaSAT thickness was observed in a 58-year-old female noncycler. Red lines indicate the measurements of medial and lateral KaSAT thickness, which were averaged for further analysis.

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