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510 Thigh Intramuscular Fat assessed by MRI in Individuals without Radiographic Osteoarthritis or Frequent Pain in the knee and hip: Associations with Age, Sex, and BMI using Data from the Osteoarthritis Initiative

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THIGH INTRAMUSCULAR FAT ASSESSED BY MRI IN INDIVIDUALS WITHOUT RADIOGRAPHIC OSTEOARTHRITIS OR FREQUENT PAIN IN THE KNEE AND HIP: ASSOCIATIONS WITH AGE, SEX, AND BMI USING DATA FROM THE OSTEOARTHRITIS INITIATIVE

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Purpose (the aim of the study): The association of thigh intramuscular fat and knee OA has been investigated in previous studies. However, quantifying intramuscular fat in individuals without OA remains unexplored. This study aimed to (1) estimate the degree of thigh intramuscular fat in individuals without radiographic OA or frequent pain in the knee or hip, and to (2) assess the associations of age, sex, and BMI with the degree of intramuscular fat.

Methods: We analyzed thigh intramuscular fat assessed by MRI in 710 individuals (44.5%/55.5% males/females, mean age = 59.8 ± 9.0 years, mean BMI = 27.1 ± 4.3 kg/m^2) from the Osteoarthritis Initiative without knee or hip radiographic OA or total joint arthroplasty, and without frequent knee or hip pain. MR imaging was performed using 3T MRI; axial T1-weighted spin echo images were assessed for intramuscular fat using the Goutallier Grading (GG) scale (0: normal muscle. 1: some fatty streaks. 2: less fat than muscle. 3: equal amounts of fat and muscle. 4: more fat than muscle). The following muscles were graded (right and left thighs): knee extensors (quadriceps) included the vastus medialis (VM), vastus lateralis (VL), vastus intermedius (VI), rectus femoris (RF), and knee flexors (hamstrings) included the semimembranosus (SM), semitendinosus (ST), and biceps femoris (BF).

Mixed effects models were used to separately assess the relationship of each demographic variable (age, sex, and BMI) and muscle type with GG outcomes by including an interaction between each demographic characteristic and muscle type. Models accounted for two thighs per person and seven muscle types per thigh and were adjusted for BMI, age, sex, and Physical Activity Scale for the Elderly (PASE). If the interaction was significant, individual models in each muscle type were implemented. To evaluate potential variations in the relationship between BMI and GG based on sex, a BMI-sex interaction, along with corresponding two-way interactions, were added to the initial model described above. Starting with the highest order interaction, the interaction terms were removed from the model if they were not statistically significant.

Results: The most prevalent GGs among the muscles were Grades 1 and 2; however, Grade 0 was most frequent in RF (58.4%). Grade 4 was infrequent across the muscles with < 1%.

The interactions between demographics and muscle type for association with GG grade were statistically significant for BMI (p=0.0003), age (p < 0.0001), and sex (p < 0.0001), suggesting that the associations between demographics and GG vary by muscle type **(Figure 1)**. A positive relationship between BMI and GG was evident (p < 0.0001 for all muscles), with coefficients (representing change in GG for every 1 unit increase in BMI) ranging from 0.038 in the ST to 0.051 in the SM. Similarly, a positive association (p < 0.0001) was observed between age and GG (coefficients ranging from 0.017 in the ST and BF to 0.023 in the VM and VL). Women had greater GG than men in all muscles (greatest difference in the VM: coeff.=0.214, p < 0.0001 and smallest difference in the RF (coeff.=0.088, p=0.037) and SM (coeff.=0.088, p=0.049). The interaction between BMI-sex was statistically significant (p=0.029), demonstrating that the association between BMI and GG varied by sex, and was similar for all muscles (BMI-sex-muscle type interaction was not statistically significant, p=0.21). At lower BMI, women had greater intramuscular fat than men, but at higher BMI, men had greater intramuscular fat than women (**Figure 1**).

Conclusions: Individuals without radiographic hip or knee OA and without frequent pain generally exhibit low GG grades of thigh intramuscular fat. In these individuals, greater BMI and age were associated with higher levels of intramuscular fat, and women tended to have higher levels of intramuscular fat than men. The relationship between BMI and intramuscular fat varied by sex, possibly due to sex-specific differences related to hormonal changes in obesity.

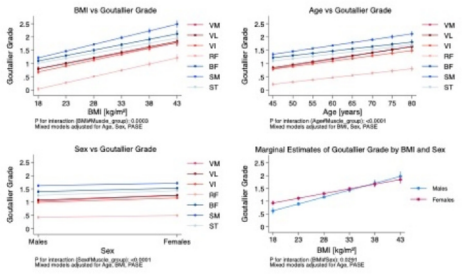

Figure 1:
The graphs illustrate the associations between BMI, age, and sex with GG. In the graphs on the top row and bottom left, the red color family designates the quadriceps, and the blue color family designates the hamstrings. The graph (bottom right) demonstrates statistically significant interactions between BMI and sex on GG grade (p=0.029), suggesting that the effects of BMI on GG grade vary by sex. Error bars represent 95% CIs.

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DUAL ENERGY COMPUTED TOMOGRAPHY CANNOT EFFECTIVELY DIFFERENTIATE BETWEEN BASIC CALCIUM PHOSPHATE AND CALCIUM PYROPHOSPHATE DEPOSITS IN THE CLINICAL SETTING.

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Purpose (the aim of the study): Recent reports suggested that dual-energy CT (DECT) may help discriminate between different types of calcium phosphate crystals *in vivo*, which would have important implications for the characterization of crystal deposition occurring in osteoarthritis. Our aim was to test the hypothesis that DECT can effectively differentiate basic calcium phosphate (BCP) from calcium pyrophosphate (CPP) deposition diseases.

Methods: This study was IRB-compliant. One male participant aged 71 with radiographically detected chondrocalcinosis (**figure 1**), scheduled for a total knee replacement was consented for this study. Surgical specimens of the medial meniscus, lateral meniscus, medial femoral condyle, and lateral tibial plateau were separately labeled, and examined under light microscopy, confirming the presence of CPP (and no BCP) in all 4 samples. Prior to pathology examination, specimens were also scanned using a Siemens Somatom Force with standard clinical parameters (80/150 kV, FOV: 250, exposure: 165 mAs, slice thickness: 0.6 mm, resolution: 0.488 x 0.488 mm2). Two readers (MJ and RB) obtained 4 DECT parameters: CT numbers at 80 and 150 kV, Dual-energy index (DEI), Electron density (Rho), and effective atomic number (Zeff). Regions of interest were placed on post-processed CT images using Rho/Z maps (Syngo.via, Siemens Healthineers, VB10B) in different areas of CPP deposition, trabecular bone BCP (T-BCP) and subchondral bone plate BCP (C-BCP) (**figure 1**).

Results: DECT parameters of both readers within different areas of mineralization are shown in **table 1.** The range of CT numbers at 80 KVp and 150 KVp, DEI, rho, and Zeff were generally higher than the range of T-BCP, lower than that of C-BCP, and largely overlapping with Aggregate-BCP (aggregate of T-BCP and C-BCP). This trend was consistent for both readers. For instance, the DEI of CPP was 0.12 ± 0.02 for reader 1 and 0.09