KNEE JOINT ADAPTATIONS IN WOMEN VOLLEYBALL ATHLETES IN RESPONSE TO A 12 – WEEK COMPETITIVE SEASON

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BACKGROUND

- Patellofemoral Pain Syndrome (PFPS) is common in women athletes in high-impact sports like volleyball.
- Magnetic Resonance Imaging (MRI) and the Victorian Institute of Sport Assessment – Patella (VISA-P) questionnaire are valuable tools for assessing PFPS and knee joint health.
- Increased athlete workload (WL) may exacerbate PFPS symptoms, highlighting the need for monitoring.

PURPOSE

Investigate how MRI-based knee joint changes relate to VISA-P scores, athlete workload, and neuromuscular performance across a 12-week competitive volleyball season.

METHODS

Participants:

- NCAA Division I women's volleyball athletes (n=7; age: 19.59 ± 1.50 yrs).

Pre/Post Measures:

- *MRI:* Patellar tendon thickness (Proximal (MRI-PPT), Middle (MRI-MPTT), Distal (MRI-DPTT)) [Fig .A], patellar height ratios (Insall-Salvati (IS) ratio (Insall-Salvati (IS), Caton Deschamps (CD), Blackburne-Peel (BP)) [Fig. B], and patellar angle measurements (Patellar Tilt Angle (PTA), Lateral Trochlear Inclination (LTI) and sulcus angle (SA) [Fig. C&D].
- *VISA-P:* Self-reported PFPS symptoms.
- *Neuromuscular:* CMJ jump height (JH), reactive strength index modified (RSImod), peak power (PP), CMJ depth, concentric duration, and eccentric duration.

Workload: IMU-based jump count (JC) and elevated landings (EL) tracked across season.

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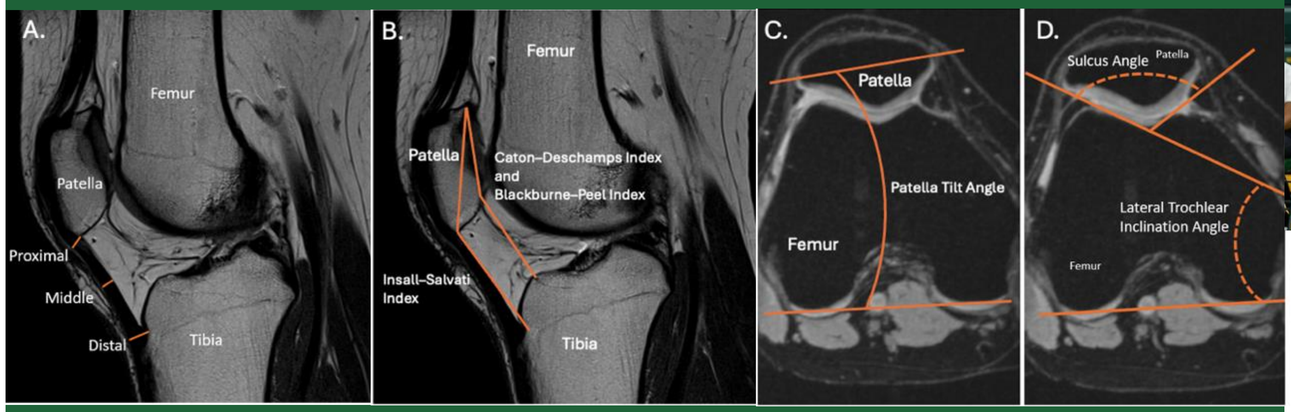
KEY FINDINGS

Knee joint structural changes are significantly linked to workload and performance metrics in women volleyball athletes.



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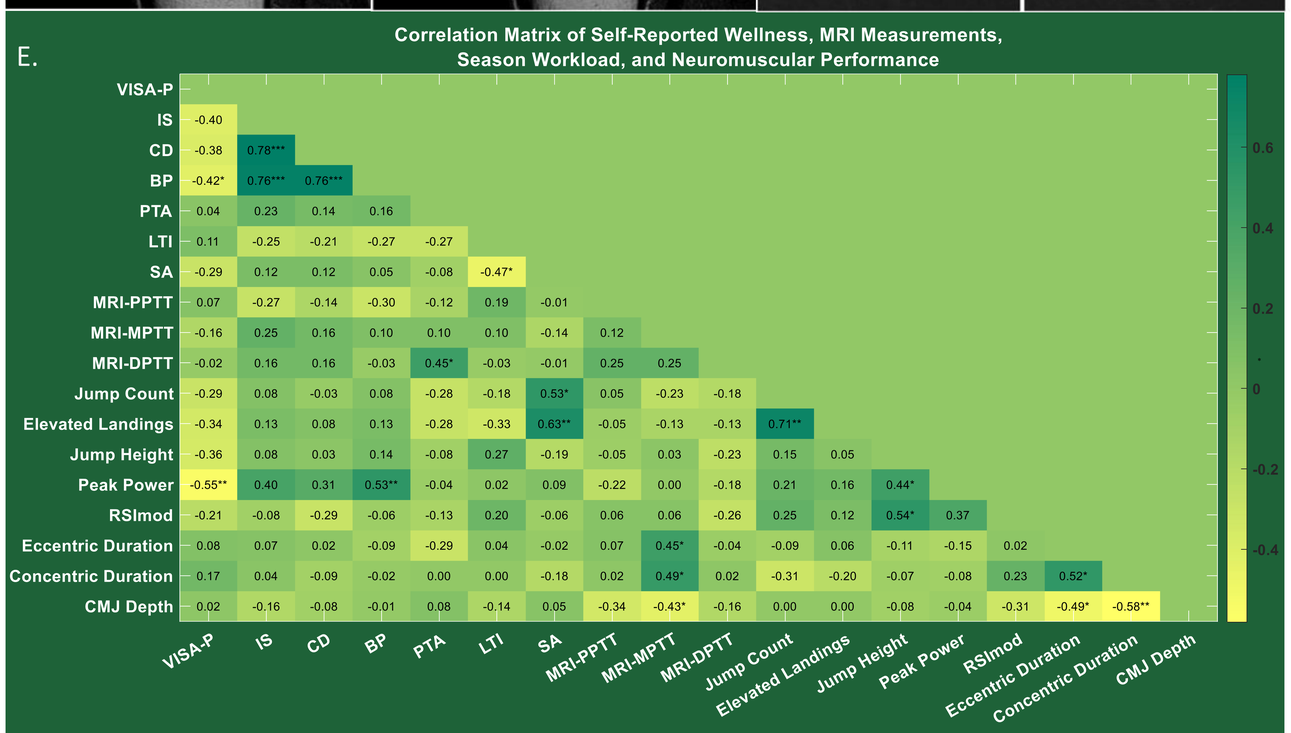

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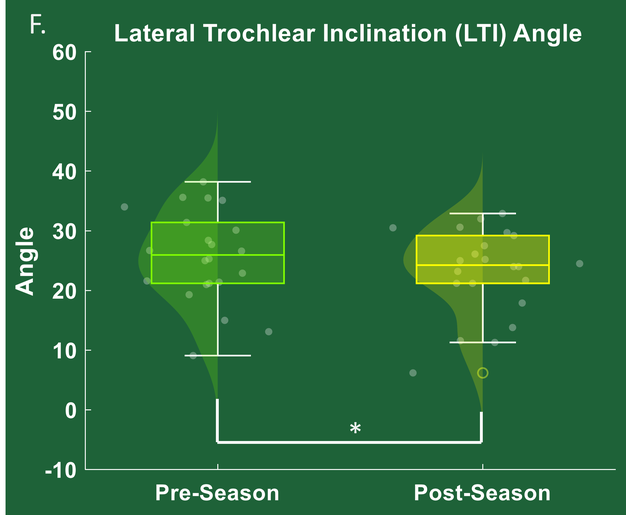

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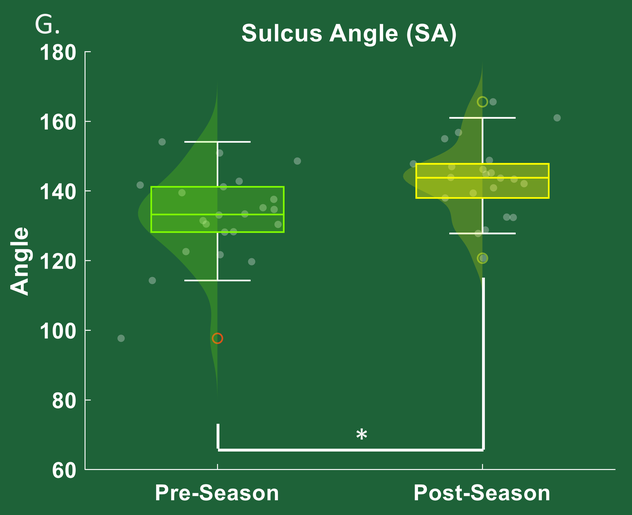

STATISTICAL ANALYSIS

- Pearson correlations assessed relationships between MRI, workload, VISA-P, and performance metrics [Fig. E].
- MANOVA tested overall timepoint effects.
- Follow-up ANOVAs identified specific variable changes.
- Statistical significance was set at $p < 0.05$. All analyses were performed in R.

RESULTS

MRI & Workload:

- SA significantly correlated with JC and EL.

MRI & Performance:

- Peak power is significantly correlated with BP.
- VISA-P is significantly negatively correlated to BP, and Peak Power
- MRI-MPTT is significantly correlated to eccentric and concentric duration, and CMJ depth

Time Effects:

- MANOVA showed significant changes across timepoints.
- LTI and SA significantly changed over the season [Fig. F&G].

CONCLUSIONS and PRACTICAL APPLICATIONS

- Monitoring structural knee changes helps identify early signs of PFPS.
- Adjusting training loads based on MRI and workload data may prevent injury.
- Integrating imaging and performance metrics supports long-term athlete health and performance.

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