



DXA for healthier Esports and beyond

Pinpointing the risks of competitive gaming and sitting too much

Once a niche pastime for die-hard gamers, esports has officially leveled up — now a global phenomenon with over half a billion fans. Tournaments pack arenas and draw millions of online viewers, turning top players into celebrities and transforming matches into major entertainment events. Like traditional sports, professional gamers train intensively, compete for high stakes, and also face painful injuries. While esports may appear low-impact, the physical toll is real, prompting dedicated research to reduce health risks. Experts believe the resulting insights could also benefit millions of people who spend hours each day parked at a desk.

Competitive esports athletes experience several health challenges linked to prolonged sitting, repetitive muscle use, and limited physical activity. While studies highlight issues such as higher body fat percentages than non-gamers^{1,2} and a greater prevalence of back pain³, clinicians are focusing on notable gaps in research—questions that could be answered with DXA imaging.

DXA scans are a major component of the clinical approach at the New York institute of technology college of osteopathic medicine (NYITCOM), which established the center for esports medicine in 2018 to address the unique physical

and musculoskeletal demands on professional gamers. The center provides specialized services ranging from DXA scans and ergonomic evaluations to customized fitness and recovery plans.

Leading the effort is Dr. Joanne Donoghue, a prominent figure in esports medicine, who relies on advanced DXA technology to obtain precise body composition data for her research. In her role as director of clinical research at NYITCOM, she conducts assessments that measure lean mass, fat mass, and bone density—critical metrics not captured by standard measures.

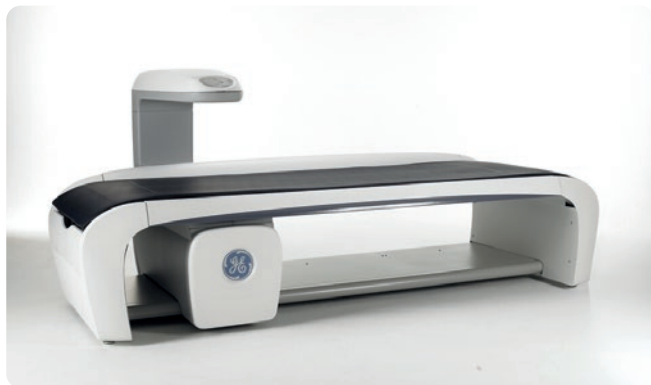


Donoghue's latest study, "Where Muscle Matters: How Regional Differences, Pain, and Gender Define Gamer Health"⁴, focuses on forearm and upper arm muscle imbalances. We recently asked Dr. Donoghue to share more on her comprehensive research and the value of DXA technology in her practice.

Can you describe your work at NYITCOM and your main areas of interest?

Dr. Donoghue:

At NYITCOM, I research esports players and other populations to prevent injury, optimize performance and recovery, and promote overall wellbeing. My focus is on leveraging DXA data to tailor interventions that improve body composition — not just BMI and weight.



We utilize GE HealthCare Lunar iDXA equipment as a key tool for advanced body composition analysis, helping us understand the unique physiological demands on esports athletes, as well as the health challenges affecting our student body linked to sedentary habits like obesity.

I've dedicated over 26 years to advancing research, authoring more than 25 peer-reviewed publications and presenting internationally. This research has been supported by organizations such as the NIH and the Michael J. Fox Foundation.

As a leading voice in esports medicine, can you describe some of your previous research on the physiological impacts of gaming on professional athletes?

Dr. Donoghue:

Our prior research investigated body composition, muscle mass, and health outcomes in esports athletes.¹ We demonstrated that competitive video gamers exhibit lower lean body mass (LBM), appendicular lean mass (ALM), and bone mineral content (BMC), alongside higher body fat compared to age-matched and BMI matched controls. These findings highlighted the consequences of prolonged sedentary behavior paired with repetitive upper limb use in esports players.

What were the key drivers behind your latest study?

Dr. Donoghue:

Our current study expands on the prior insights by focusing on forearm, upper arm muscle imbalances — a key area affected by the repetitive, high-frequency motions inherent in esports.

Given that gamers can perform over 500 actions per second with their hands and wrists, our aim is to assess the relationship between LBM, fat-to-lean mass ratio, and functional grip strength in dominant versus non-dominant forearms.

We used GE HealthCare Lunar iDXA™ technology and correlated these measures with musculoskeletal pain. This work will help identify early markers of overuse injuries and guide targeted interventions to prolong careers and optimize performance.

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Who were the participants in your study, and what were the primary data points collected for analysis?

Dr. Donoghue:

We studied 30 competitive gamers and 30 non-gamers, matched by age and BMI. The gamers — both men and women — were recruited from collegiate and professional esports teams and played first-person shooter games for at least 3 hours daily. Controls were non-gamers with similar demographics.

Using Lunar iDXA with enCORE v18, we looked at several key measurements. We assessed regional lean body mass, analyzing specific areas, including the total upper body, forearms, and the lower body. We also measured regional fat distribution — allowing for a detailed fat-to-lean mass (FTLM) ratio assessment. In addition, we analyzed bone mineral density using Z-scores to explore differences in bone health.

These measurements enabled precise comparisons between gamers and controls, revealing regional disparities in LBM and FTLM ratios, both of which are indicators of muscle quality and function. Additionally, the data revealed correlations between regional LBM and handgrip strength, measured using a Jamar Dynamometer, as well as self-reported musculoskeletal pain, particularly in the forearms, upper body, and lower back in the male participants.

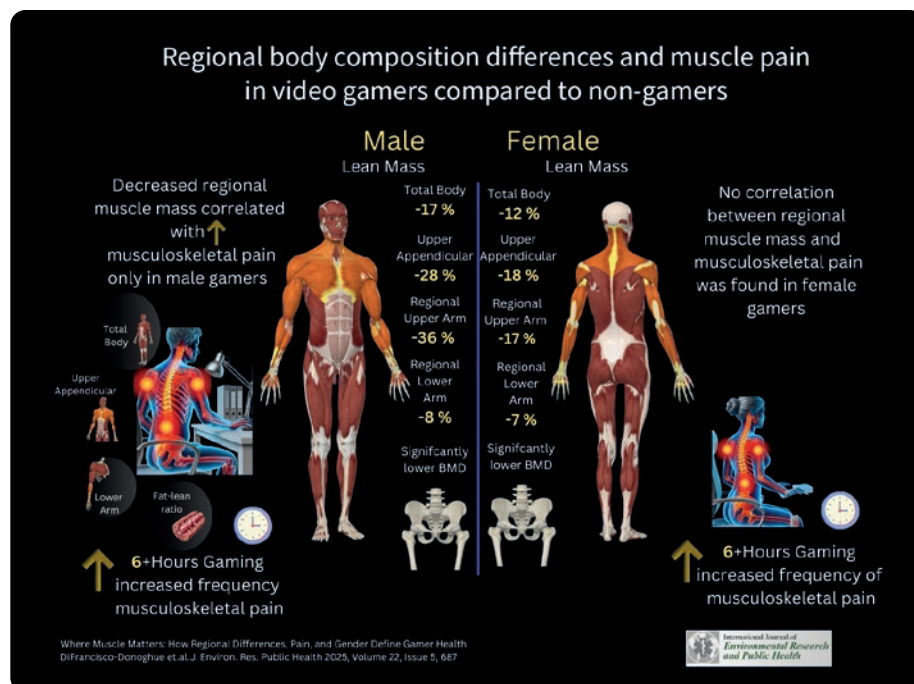
What were your main findings?

Dr. Donoghue:

The study highlights significant differences in body composition, bone mineral density, physical activity, and sedentary behavior between gamers and control groups for both men and women.

Men gamers had significantly lower lean body mass, fat-free mass, and relative skeletal muscle index compared to controls, with notable reductions in both upper and lower body LBM, and higher fat-to-lean mass ratios. They also exhibited lower bone mineral density (Z-scores) and significantly weaker grip strength in both dominant and non-dominant hands.

In women gamers, similar trends were observed, with lower LBM, fat-free mass, and relative skeletal muscle index, particularly in the upper and lower body, alongside reduced bone mineral density. Women gamers also reported significantly less cardiovascular exercise and weightlifting time weekly, coupled with significantly more time spent sitting compared to controls.



Considering the high standards and daily demands of today's clinical practice, how did Lunar iDXA equipment perform in terms of precision and reliability?

Dr. Donoghue:

Lunar iDXA with enCORE v18 proved to be an exceptionally effective and reliable tool for measuring body composition in our study. Having used this machine for over 10 years across various research projects, I can confidently attest to its reliability, precision, and practicality.

Lunar iDXA allows for quick and detailed regional analysis of lean body mass (LBM) and fat mass, which was essential for our study, particularly in assessing forearm-specific differences and fat-to-lean mass ratios. These precise measurements provided us with valuable insights into muscle quality and imbalances — critical for identifying early signs of musculoskeletal issues in competitive gamers.

The machine's efficiency and user-friendly design make it an ideal choice for both clinical and research settings, ensuring minimal participant burden while delivering high-quality, reproducible results. I highly recommend it for any application requiring advanced body composition assessment.



More specifically, what was the significance of the enCORE v18 technology in your study?

Dr. Donoghue:

The enCORE v18 software was instrumental in our research because it enabled precise regional analysis of lean body mass (LBM) and fat mass, which was critical for assessing the fat-to-lean mass ratio in specific areas like the forearms and upper arms.

This level of detail provided a deeper understanding of the relationship between body composition and function — especially in sports athletes, where repetitive upper limb use can cause

muscle imbalances and functional deficits. The ability to isolate and analyze LBM and fat mass by region made it possible to identify subtle changes that might otherwise go unnoticed.

This enabled a precise evaluation of how fat-to-lean ratios impact overall performance and function. This regional specificity provided by enCORE v18 gave us an accurate and actionable indicator of musculoskeletal health and functional capacity.

Do you think the insights obtained from the DXA data may be used to drive changes in the esports and gaming space?

Dr. Donoghue:

Absolutely. The insights obtained from the DXA results are groundbreaking and have the potential to drive significant changes in the esports and gaming space. This study is the first of its kind to highlight the shocking differences in body composition, particularly the reduced bone mineral density and lean body mass in gamers at such a young age.

What's particularly striking is the discovery of gender differences — with female gamers showing better forearm function despite reduced upper body LBM. These findings challenge current assumptions about esports health and emphasize the urgent need for targeted interventions, including ergonomic adaptations, strength training programs, and proactive health monitoring.

By sharing these insights, we can advocate for a shift in how the esports industry supports players — prioritizing long-term musculoskeletal health to optimize performance, extend careers, and ensure the wellbeing of athletes, both male and female.

Did your results lead to any further unanswered questions or areas of interest you would like to investigate?

Dr. Donoghue:

Our results have highlighted several unanswered questions and areas of interest that warrant further investigation. One of the most compelling findings was the gender differences in strength, fat-to-lean mass ratios, and reported muscle pain. While female gamers maintained forearm strength despite reduced lean body mass, male gamers exhibited significant declines in both LBM and grip strength.

These findings raise important questions: Why do gender differences exist in muscle function and composition, particularly in response to prolonged gaming? How do fat-to-lean mass ratios influence muscle quality, endurance, and susceptibility to pain, and why do these metrics differ between men and women? What underlying mechanisms drive the differences in musculoskeletal pain between genders, and how can interventions be tailored accordingly?

Exploring these questions could provide critical insights into gender-specific health risks in esports and sedentary populations, guiding the development of targeted training, ergonomic interventions, and injury prevention strategies. This area remains underexplored, and I am eager to further investigate these gender-based disparities to improve health outcomes for all.

Do you think some of the outcomes in your research could apply to those living sedentary lifestyles, especially with the increase in remote working post-pandemic?

Dr. Donoghue:

Absolutely. The outcomes of this research have tremendous implications for individuals leading a sedentary lifestyle and with rising obesity rates, particularly in the post-COVID-19 era with the rise of remote work.

The study highlights the impact of prolonged sitting combined with repetitive upper limb movements, which affects not only esports athletes but also people working long hours at a desk. The findings related to reduced lean body mass, bone mineral density, and increased musculoskeletal pain — especially in the lower back, shoulders, and forearms — are highly relevant.

This research underscores the importance of incorporating movement breaks, strength training, and ergonomic adjustments into daily routines to mitigate these adverse health effects. The insights gained can help inform strategies to promote healthier habits and reduce the risk of long-term musculoskeletal issues for both gamers and remote workers alike.

Do you believe research like yours will lead to more widespread use of DXA, helping identify risks like obesity or chronic injury earlier on?

Dr. Donoghue:

I absolutely expect that research like mine will drive the more frequent use of DXA for a section of the population at particular risk of obesity. With the growing use of GLP-1 receptor agonists and other weight loss drugs, body composition can change drastically — often beyond what is reflected by simple metrics like weight or BMI. DXA is uniquely suited to capture these changes reliably, providing a clear breakdown of lean mass, fat mass, and bone mineral density.

Furthermore, DXA's ability to pinpoint regional differences — like reduced upper or lower body LBM — demonstrates how certain lifestyles, like prolonged sitting in gamers, can disproportionately affect muscle and bone health. These findings make a strong case for using DXA scans to monitor at-risk populations, enabling early detection of musculoskeletal declines, and informing targeted interventions, such as resistance training and ergonomic improvements, to mitigate health risks.



What is inspiring your next research direction, and what kind of impact do you hope to achieve with it?

Dr. Donoghue:

At the center for esports medicine at NYITCOM, our research is expanding to address the broader physiological and cognitive consequences of gaming and prolonged sedentary behavior — with an emphasis on sex-based differences, functional outcomes, and early intervention strategies.

One of our most striking findings is the link between reduced regional lean mass and musculoskeletal pain, particularly in the forearms and lower back for male participants. These physical imbalances may also influence cognitive fatigue and executive functioning in male participants — a hypothesis we plan to investigate through functional imaging techniques, including MRI. By integrating DXA-derived body composition data with neural and behavioral metrics, we aim to better understand how muscle quality affects both physical and cognitive performance.

Ultimately, our goal is to integrate DXA-driven insights with cognitive performance metrics to develop targeted interventions — whether for elite gamers or remote workers — that enhance long-term health, performance, and quality of life in digitally dominant environments.



Read the full article:

www.mdpi.com/1660-4601/22/5/687



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