SEASONAL CHANGES IN COUNTERMOVEMENT JUMP AND ISOKINETIC STRENGTH PERFORMANCE IN WOMEN COLLEGIATE LACROSSE ATHLETES

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BACKGROUND

- Athletes need to be prescribed training loads that elicit positive adaptations.
- Training loads that are too high may result in neuromuscular (NM) fatigue and increased injury.
- Lower body NM function can be monitored via countermovement jump (CMJ) and isokinetic strength testing.
- Limited data exist in seasonal changes in NM performance in collegiate women athletes.

PURPOSE

- To investigate seasonal changes in lower body neuromuscular performance in women collegiate lacrosse athletes.

METHODS

- National Collegiate Athletic Association Division I women lacrosse athletes (n=9, mean ± SD; age=19.1±0.9 years, height=168.4±6.8 cm, body mass=69.0±7.8 kg) participated in 4 testing sessions over a training year (figure 1).
- Athletes performed 3 CMJ on a force plate from which reactive strength index modified (RSImod), jump height, relative values of unloading force (UF), braking force (BF), peak power (PP), peak propulsive force (PPF), and landing force (LF) were collected (figure 2).
- In the same session, isokinetic strength testing was utilized to assess concentric and eccentric quadriceps and hamstring strength for the dominant (D) and non-dominant (ND) legs (figure 3).
- Athletes performed 5 repetitions at 60°/s and 7 repetitions at 300°/s
- Repeated measures analysis of variance (ANOVA) assessed changes in strength and power across time.
- If significance was observed ($p<0.05$), Bonferroni post-hoc analysis was used.

KEY FINDINGS

- Increased lower body strength was observed following the competitive season with no decrements in neuromuscular performance.
- CMJ performance decreased during off-season training.

Table 1. Countermovement jump performance across time points

	Time 1 (October)	Time 2 (December)	Time 3 (May)	Time 4 (August)
RSImod	1.13 (0.28)	1.13 (0.16)*	1.12 (0.16)	0.95 (0.16)
Jump height (cm)	39.18 (6.78)	41.06 (5.10)	41.67 (4.98)	40.08 (4.48)
UF (N/kg)	0.30 (0.15)*	0.34 (0.13)	0.29 (0.12)	0.49 (0.17)
BF (N/kg)	2.47 (0.25)	2.46 (0.21)*	2.41 (0.15)	2.27 (0.23)
PP (W/kg)	4.80 (0.65)	4.92 (0.49)	4.97 (0.36)*	4.70 (0.38)
PPF (N/kg)	2.50 (0.28)	2.49 (0.22)*	2.42 (0.15)	2.32 (0.21)
LF (N/kg)	4.51 (0.60)	4.37 (0.57)	4.23 (0.85)	4.10 (0.62)

Values are represented as mean ± standard deviation
*denotes significant difference from time point 4

RSImod= reactive strength index modified, UF= relative unloading force, BF= relative breaking force, PP= relative peak power, PPF= relative peak propulsive force, LF= relative landing force

Figure 4a. Dominant Leg Concentric Strength (60 deg/s)

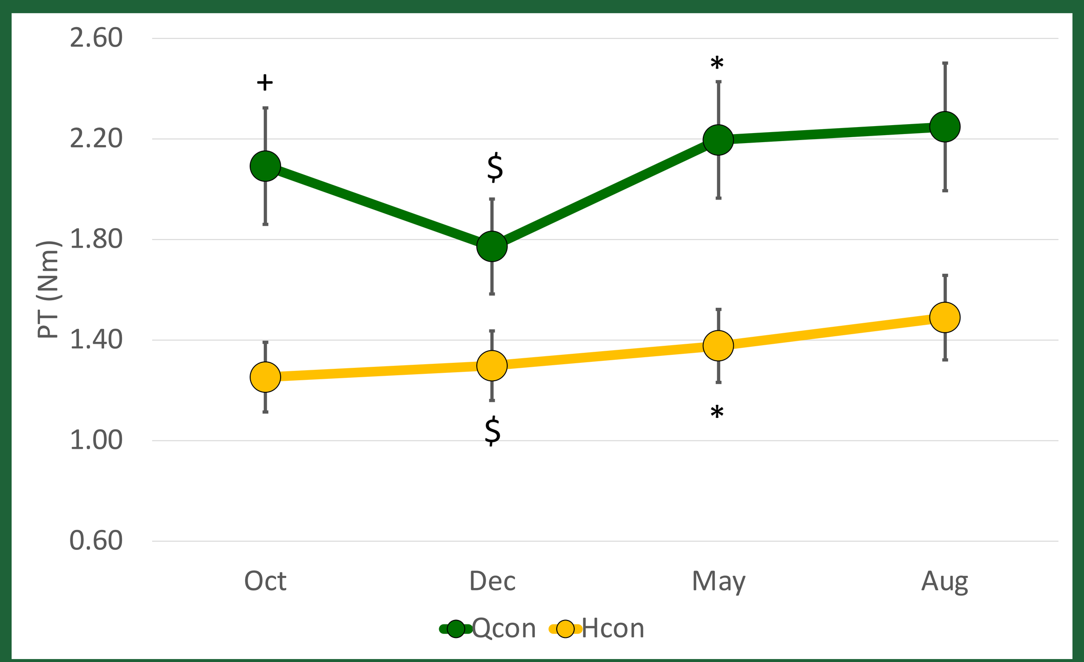


Figure 5a. Non-Dominant Leg Concentric Strength (60 deg/s)

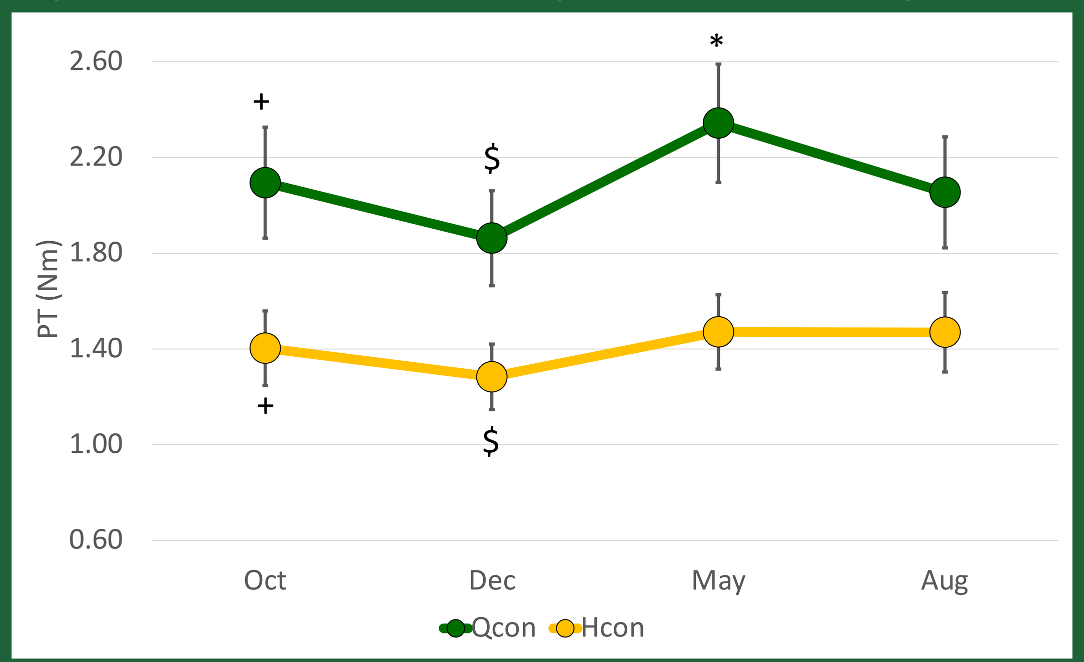


Figure 4b. Dominant Leg Eccentric Strength (60 deg/s)

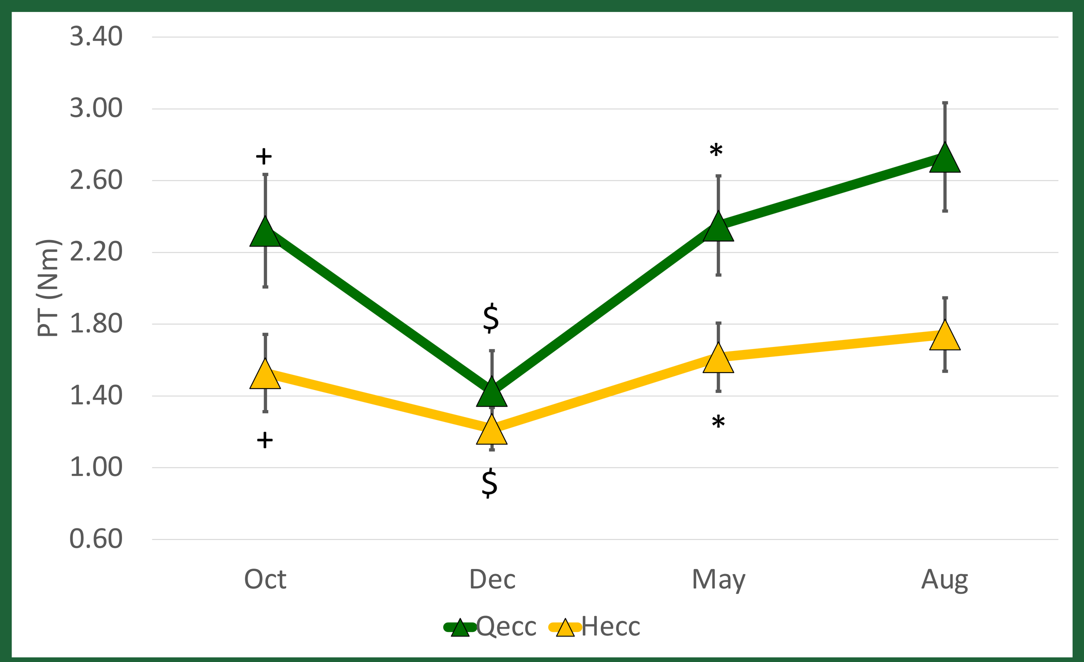
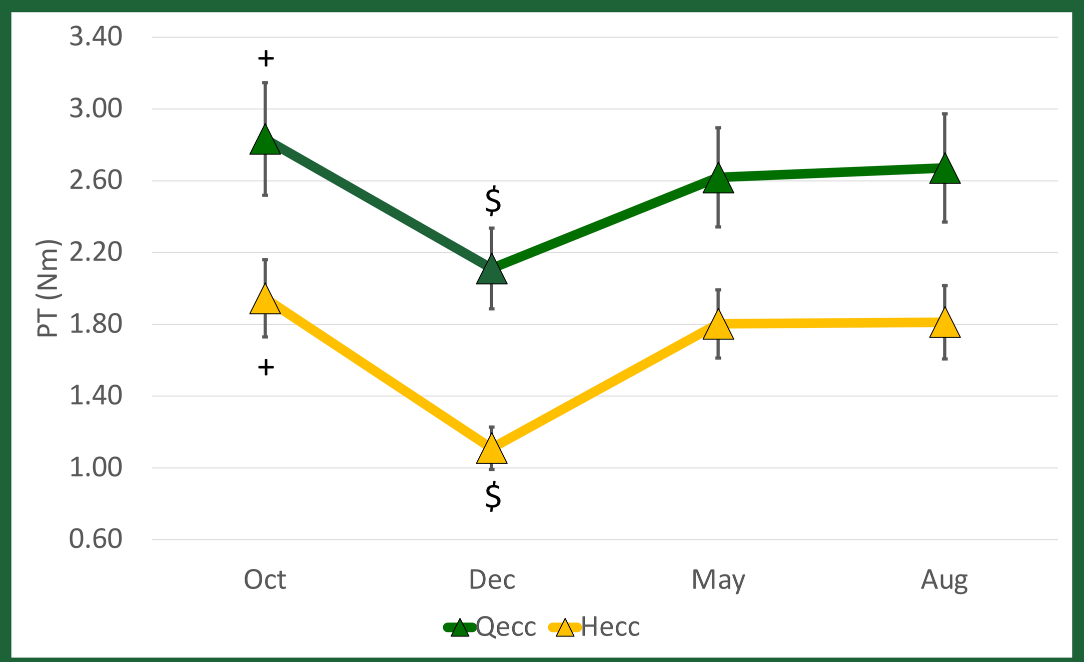


Figure 5b. Non-Dominant Leg Eccentric Strength (60 deg/s)



Values are represented as mean ± standard deviation
Qcon= quadriceps concentric strength, Qecc= quadriceps eccentric strength, Hcon= hamstring eccentric strength, Hecc= hamstring eccentric strength
+Indicates significance when compared to time 2
$Indicates significance when compared to time 3
*Indicates significance when compared to time 4

Figure 1: Testing time points

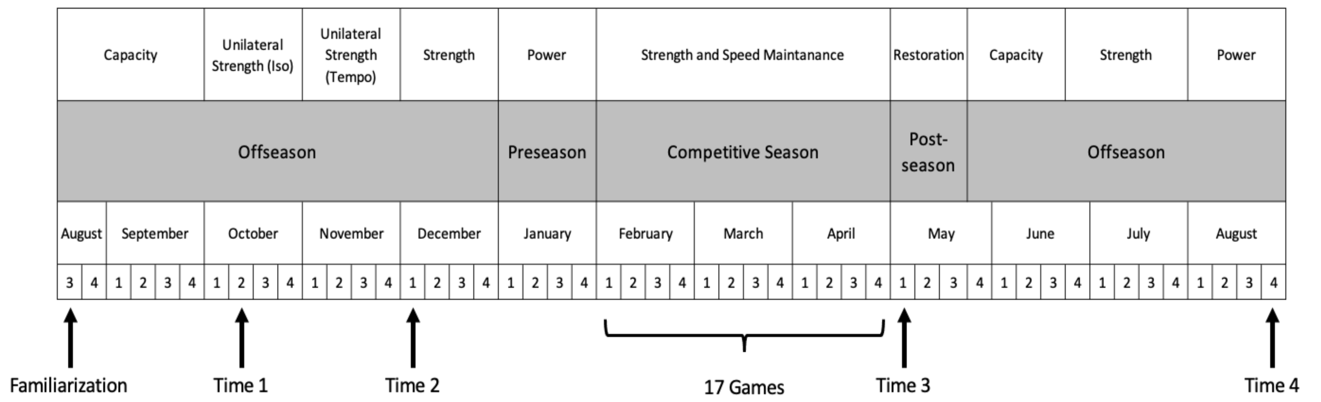


Figure 2: CMJ testing

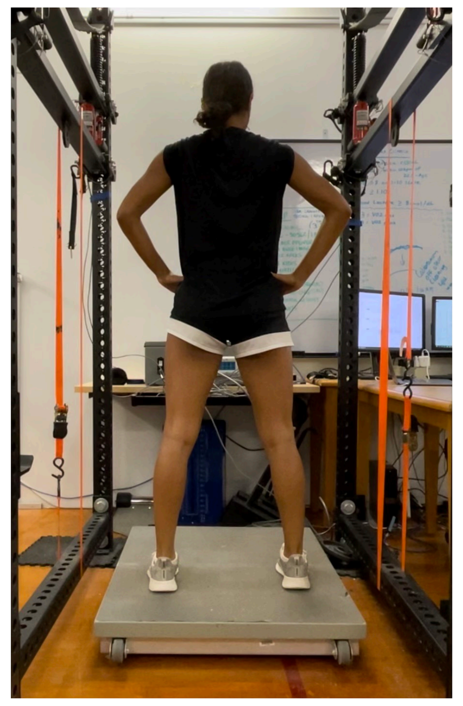


Figure 3: Isokinetic testing

RESULTS

- RSImod (p=0.03), PPF (p=0.006), and BF (p=0.004) decreased between time 2 and 4, and PP decreased from time 3 to time 4 (p=0.013). UF increased from time 1 to time 4 (p=0.022) (table 1).
- No changes were observed in isokinetic strength at 300°/s for either leg.
- Isokinetic strength at 60°/s decreased from time 1 to 2 ($p<0.001$) for D leg quadriceps concentric and eccentric, and D leg hamstring eccentric (fig. 4a-b).
- Isokinetic strength at 60°/s decreased from time 1 to 2 ($p<0.001$) for ND leg quadriceps concentric and eccentric quadriceps, and ND leg hamstring concentric and eccentric (figure 5a-b).
- All isokinetic variables at 60°/s increased from time 2 to 3 ($p<0.001$) (figures 4a-b, and 5a-b).
- From time 3 to 4, quadriceps and hamstring concentric and eccentric strength increased for D leg and decreased quadriceps concentric for ND ($p<0.001$) (figures 4a-b, and 5a-b).

CONCLUSIONS and PRACTICAL APPLICATIONS

- No mal-adaptations resulted from the competitive season. Lower body strength at 60°/s improved.
- Off-season training decreased CMJ performance, which may indicate athletes were fatigued from training or became detrained over the summer break.
- Direct supervision from a certified strength and conditioning specialist is recommended throughout the training year.
- RSImod may be a cost-effective variable for detecting NM fatigue.