ASSOCIATIONS BETWEEN ASSYMERIES IN LEG LEAN MASS AND COUNTERMOVEMENT JUMP KINETICS IN DIVISION I COLLEGIATE FOOTBALL ATHLETES.

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Abstract

INTRODUCTION: Inter-limb asymmetries offer practitioners benchmarks for monitoring training efficacy, injury risk, and return to sport. The Countermovement Jump (CMJ) and leg lean mass derived from Dual-Energy X-ray Absorptiometry (DXA) offer common means of assessing inter-limb asymmetries. Previous work in athletes has shown that Leg Lean Mass Asymmetry Index (LLM AI) is correlated with CMJ asymmetries. Football is unique from other sports in that anthropometrics and performance attributes differ significantly between playing position, especially with respect to Linemen (LMN) and Non-linemen (NL). To date these findings have not been replicated in NCAA Division I (DI) football athletes. The purpose of this study was to investigate associations among phase- specific CMJ asymmetries and LLM AI in NCAA DI football LMN and NL. **HYPOTHESIS:** We hypothesized that the direction of LLM AI and CMJ asymmetries would be positively correlated in both LMN and NL. **METHODS:** Twenty NL (age=20.5±1.2 years, height=185.2±4.9 cm, weight=93.8±10.4 kg) and thirteen LMN (age=22.1±1.6 years, height=191.0±4.9 cm, weight=131.5±15.4 kg) participated in the study. Tests were conducted prior to offseason training. Following a standardized dynamic warm-up, three CMJ trials with hands akimbo were performed on bilateral force plates sampling at 1000Hz (Hawkin Dynamics, Portland, ME, USA). Trials resulting in the highest jump height were analyzed for each athlete. Asymmetry indices (AI) from the braking and propulsive phase of the CMJ were included in univariate models. The AI was calculated as the percent difference between the left and right limb, where positive values indicated left limb dominance and negative values indicated right limb dominance. CMJ variables included Peak Braking Force (PBF), Braking Impulse (BI), Peak Propulsive Force (PPF), and Propulsive Impulse (PI). LLM was obtained using enCORE Software, version 15 (GE Healthcare Lunar, Madison, WI, USA). LLM AI was calculated using the same formula as CMJ variables to maintain direction of asymmetry, as is consistent with the literature. Spearman's rho was computed to assess associations between CMJ and LLM AI (α=p≤.05, two-sided). **RESULTS:** In NL, results of the Spearman correlations indicated significant positive associations between LLM AI with PBF AI (r(18)=.59,p=.01), BI AI (r(18)=.59,p=.01), PPF AI (r(18)=.70,p>.01), and PPI AI (r(18)=.60,p=.01). No significant associations were found in LMN. **CONCLUSION:** In this sample, significant associations between LLM AI and all CMJ asymmetry variables were observed in NL only. A positive correlation between LLM and CMJ AI indicates an association between the direction of LLM asymmetry phase specific CMJ peak forces and impulse. **SIGNIFICANCE:** These results indicate that monitoring CMJ asymmetries may be useful in screening for LLM asymmetries in NL only, where DXA is not available for assessing LLM. The absence of any significant associations in LMN may suggest that factors other than LLM AI contribute to inter-limb asymmetries in CMJ performance. This information is of value to practitioners as LLM asymmetry is often used to appraise training efficacy, injury risk and return to sport decisions.

Introduction

- Inter-limb asymmetries offer practitioners benchmarks for monitoring training efficacy, injury risk, and return to sport.[1,3]
- The CMJ and DXA offer common means of assessing inter-limb asymmetries.
- Previous work in athletes has shown LLM AI is correlated with CMJ asymmetries.[2]
- These findings have not yet been replicated in NCAA DI football athletes.
- The purpose of this study was to investigate associations among phase- specific CMJ asymmetries and LLM AI in NCAA DI football LMN and NL.

Methods

	Linemen (n = 13)		Non- Linemen (n = 20)	
	M	*SD*	*M*	*SD*
Age (years)	22.1	1.6	20.5	1.2
Height (cm)	191.0	4.9	185.2	4.9
Weight (kg)	131.5	15.4	93.8	10.4
BMI (kg/m^2)	36.0	3.4	27.3	2.3

Table 1. Subject demographics.

- Twenty NL and thirteen LMN participated in this study.
- Three CMJ trials with hands akimbo were performed on bilateral force plates sampling at 1000Hz (Hawkin Dynamics, Portland, ME, USA). The trials resulting in the highest jump height, as calculated using impulse-momentum theorem, were kept for analyses.
- LLM was obtained using GE iDXA and analyzed with enCORE Software, version 15 (GE Healthcare Lunar, Madison, WI, USA).
- AI was calculated as the percent difference between the left and right limb, where positive values indicated left limb dominance and negative values indicated right limb dominance.
- Spearman's rho was used to assess associations between LLM AI and CMJ Peak Braking Force (PBF), Braking Impulse (BI), Peak Propulsive Force (PPF), and Propulsive Impulse (PI) (α=p≤.05, two-sided).

$$Asymetry\ Index\ (AI) = \left(\frac{Left\ Leg - Right\ Leg}{Left\ Leg}\right) \times 100$$

Figure 1. Asymmetry index equation.

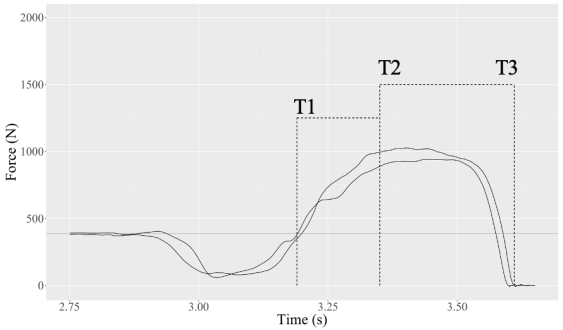

Figure 2. Braking (T1-T2) and Propulsive (T2-T3) phases of the CMJ.

Results

- In NL, results of the Spearman correlations indicated significant positive associations between LLM AI with PBF AI (r(18)=.59,p=.01), BI AI (r(18)=.59,p=.01), PPF AI (r(18)=.70,p>.01), and PPI AI (r(18)=.60,p=.01).
- No significant associations were found in LMN.

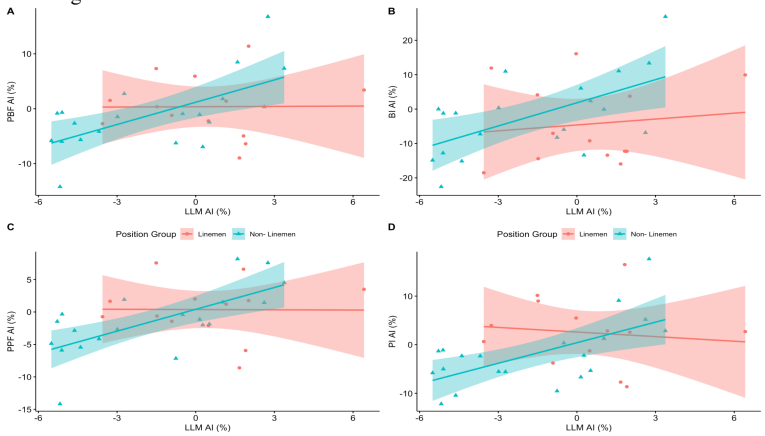

Figure 3. Spearman rank correlations and 95% CI of LLM AI and PBF AI (A), BI AI (B), PPF AI (C), and PI AI (D) for LMN and NL position groups.

Conclusions

- In this sample, significant associations between LLM AI and all CMJ asymmetry variables were observed in NL only.
- A positive correlation between LLM and CMJ AI indicates an association between the direction of LLM asymmetry phase specific CMJ peak forces and impulse

Significance

- These results indicate that monitoring CMJ asymmetries may be useful in screening for LLM asymmetries in NL only, where DXA is not available for assessing LLM.
- The absence of any significant associations in LMN may suggest that factors other than LLM AI contribute to inter-limb asymmetries in CMJ performance.
- This information is of value to practitioners as LLM asymmetry is often used to appraise training efficacy, injury risk and return to sport decisions

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