HIP ABDUCTOR MUSCLE STENGTH AND UNIPEDAL BALANCE PARAMETERS AMONG PROFESSIONAL FOOTBALL PLAYERS

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A research report

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Outline of presentation

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Introduction

- Football
  - Over 256 million active players (FIFA, 2007)
  - Lower extremity weight bearing functional activities
  - Intermittent sport that requires high physical fitness level (Otekin et al. 2009)
  - High injury incidence rate (non-contact injuries most frequent (Fletcher & Long 2013)
  - 10-15 injuries per 1000 play hours (Khodabakhshi et al. 2012)
  - Injury Prevalence rate 81.6% (Azubuike and Okojie, 2009)

Introduction

- Risk factors for LE injuries
  - poor postural stability (Zazulak et al. 2007)
  - reduced knee joint position sense (Ribeiro et al. 2008),
  - poor ankle proprioception (Mohammadi and Roozdor, 2010),
  - prior injury (Shankar et al. 2007; Butler et al. 2013),

Introduction

- Stance leg - higher levels of torque and shear force (Fletcher and Long 2013)
- Repeated impulsive contacts between feet and support surface (Ogwumike and Tijani 2011)
- Balance and position sense are principally vital to limiting this potential injury occurrence (Fletcher and Long 2013)

Introduction

- What is Balance?
  - Vital motor skill
  - Based on muscular synergies
  - Dictates movement strategies within closed kinetic chain
  - It is maintained by 3 systems
    - Barone et al. 2011
- Football requires superfluity of technical skills
- Successful execution of technical skills depend on balance (Evangelos et al. 2012).

Background

- Footballers have better standing balance (Barone etal. 2011)
  - Why kick with dominant leg?
  - Proprioception/neuromuscular control/LE muscle strength/stiffness around joints and muscles.
- Proper function & coordination of the body's core are important for providing optimal production, transfer, and control of forces and movements that occur throughout the body (McMullen et al. 2011).

Background

- Recent literature has focused on the dynamic neuromuscular control of the trunk, hip and femur over the planted leg and the role the hip abductors plays in this (Osborne et al. 2012)
- Hip abductors control frontal plane motion of pelvis-hip complex (O'Dwyer et al. 2011)
- Also control internal rotation of femur during closed kinetic chain activities (Kollock et al, 2008;French et al. 2010)
- Influences pronation at the foot (Hollman et al. 2006)
- Proximal muscles are neglected in balance investigations

Background

- Objective
  - Examine the relationship between isometric hip abductor muscle strength (IHAMS) and unipedal non-dominant leg balance parameters among football players.
- Hypothesis
  - IHAMS will be significantly correlated with unipedal balance performance among the participants

Research Method

- Research design: Descriptive correlational study
- Sampling method: Purposive sampling
- Participants
  - 32 professional footballs
  - 78% right leg dominant
- Ethical approval: NHREC/05/01/2008a
- Informed consent was obtained from all participants

Research Method

- Inclusion criteria
  - Competing in the NPL; at least 3rd division
  - 2 years prior to participation
- Instrumentation
  - IHAMS was measured using a sphygmomanometer
  - Weight and Height measured using standard method by ISAK.
  - Balance was measured using Wii balance board

Research Method

- Hip Abductor muscle strength
  - Positioning: side-lying, knee & hip flexion
  - Procedure by Arab and Nourbakhsh, 2010
  - Inflated cuff of sphygmomanometer over lateral femoral condyle
  - 5cm by 180 cm to hold cuff on test leg
- Repeated twice and average recorded in mmHg

Research Method

Figure 1: Experimental setup for Isometric hip abductor muscle strength assessment

Research Method

- Balance assessment
  - Stabilometric analysis was conducted using a Wii balance board
    - 45cm by 26.5cm platform
    - 4 transducers
    - Data filtered at 100Hz
  - Provides accurate measure of COP, COP is an important metric for balance stability (Clark et al. 2010; Sgrò et al. 2014)

Research Method

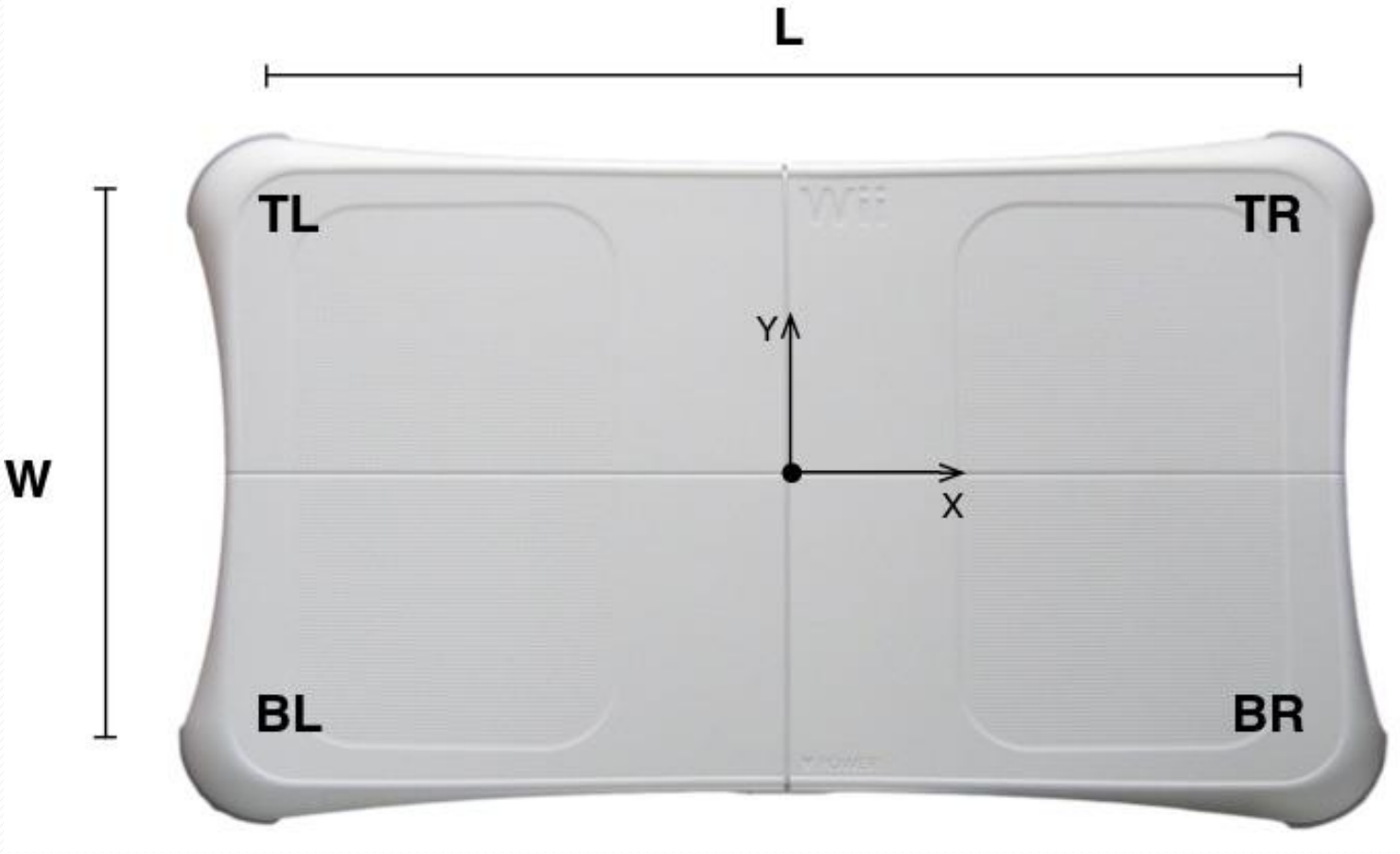

Figure 2: WBB dimensions, reference frame system and sensors position.

Research Method

- Procedure by Barone et al. 2011
  - Dominant leg was first identified as the preferred leg for kicking aball.
  - Data recorded for 5 seconds
  - Two test situations examined
  - 3 trials with 15 seconds rest
  - Balance performance were calculated as;
    - COP swaypath,
    - Anterio-posterior COP velocity and
    - Medio-lateral COP velocity

Research Method

Figure 3: Experimental setup for balance assessment

Research Method

- Balance assessment
  - COP in both *x* and *y* directions using the formula provided by Sgrò et al. (2014)

$$\mathbf{COPx} = (\mathbf{L}/2) * \frac{(\mathbf{TL} + \mathbf{BR}) - (\mathbf{TL} + \mathbf{BL})}{\mathbf{TR} + \mathbf{TL} + \mathbf{BR} + \mathbf{BL}}$$

$$\mathbf{COPy} = (\mathbf{W}/2) * \frac{(\mathbf{TL} + \mathbf{TL}) - (\mathbf{BR} + \mathbf{BL})}{\mathbf{TR} + \mathbf{TL} + \mathbf{BR} + \mathbf{BL}}$$

Research Method

- Data analysis;
  - Shapiro-Wilk test of normality
  - Mean and standard deviation to summarize data
  - Spearman correlation to explore relationship between IHAMS and non-dominant leg unipedal balance
  - Alpha level set at 0.05

Results

Table 1: Physical Attributes of Participants

Attributes	Range(n=32)	X±SD (n=32)
Age (years)	20 – 37	28.19 ± 4.10
Weight (kg)	34 – 80	71.31 ± 7.45
Height (m)	1.57 – 1.93	1.76 ± 0.07
IHAMS (mmHg)	110 – 180	140.50 ± 20.55

Key

IHAMS - Isometric Hip abductor muscles' strength

Results

Table 2: Correlation between isometric hip abductor muscle strength and balance parameters during eyes-open and eyes-closed balance tests

		Eyes-open	Eyes close
COP Swaypath (mm)	r	-0.019	-0.271
	p	0.920	0.134
Anterio-posterior	r	0.217	-0.138
velocity (mm/s)	p	0.232	0.451
Medial-lateral velocity	R	-0.246	-0.331
(mm/s)	P	0.175	0.064

Discussion

- Non-dominant leg balance parameters scores were higher compared to those reported by Barone et al. 2010.
  - frequency and duration influences the consistency of COP descriptive measures (van der Kooij et al)
  - sampling duration, number of trials and visual condition are the most important

Discussion

- No significant relationship was found
  - HA supports body weight and contributes to medial GRF at all speed (John et al. 2012)
  - Hip abductor muscles play an important role in medio-lateral balance control (Arvin et al. 2016)
- Reduces hip abductor strength = change in strategy from hip to ankle (Lee and Powers, 2014)

Implication

- There seem to be an inverse relationship between IHAMS and unipedal balance, though not statistically significant

- The lateral stability may/not be influential in the better unipedal non-dominant leg balance reported.

Limitations

- Small sample
- Unipedal assessment devoid of weight shifting task
- Result generalisation may be inappropriate
- Fatigue

Future Research

- Further studies should ;
  - include a larger sample size and
  - utilize more objective methods to assess the influence of hip abductor muscle strength.
  - EMG of hip muscles during unipedal balance activities

Conclusion & Recommendations

- None of the parameters of unipedal non-dominant leg balance correlates with hip abductor muscle strength.

- Recommendation
  - Balance training,
  - LE rehabilitation
  - and injury prevention programmes

  - should include hip abductor muscle strengthening

Highlights

- No correlation between IHAMS and non-dominant leg balance
- With increased IHAMS, footballers show better non-dominant leg balance parameters.
- The lateral stability have no association with non-dominant leg balance recorded

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Questions?