

COMPARISON OF IMBALANCE OF HIP, PELVIC TILT, BALANCE AND ENDURANCE FITNESS BETWEEN PROFESSIONAL ATHLETES AND NON PROFESSIONAL ATHLETES HAVING FUNCTIONAL LIMB LENGTH DISCREPANCY

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Abstract

Background: Long distance runners are mainly suffered from overuse injuries in the lower extremities. One of the potential risk factors for running injuries is Limb Length Discrepancy. Functional LLD leads to overuse injuries in runners. If there is an imbalance in the length-tension relationships and improper dynamic posture during movement, the constant tug of war between muscles can prematurely lead to muscle, joint, tendon and ligament injuries. **Methods:** 30 athletes (mean age 15 ± 1.13 and 19.63 ± 1.22) with functional LLD were selected according to their inclusion and exclusion criteria and they were selected for further study. **Results:** For the balance i.e. static balance and dynamic balance, the result showed non-significant difference between professional athlete and recreational athletes with FLLD. For pelvic tilt, the result of study showed non-significant difference between professional athlete and recreational athletes. For the aerobic fitness the data obtained from the study showed a significant difference between professional athletes and recreational athletes with FLLD. **Conclusion:** It has been concluded that there is a significant difference in aerobic fitness and dynamic balance (in posterolateral, posterior and postero-medial directions) between professional athletes and recreational athletes having FLLD. It has been concluded that there is positive correlation between FLLD and hip abductor strength, hip extensor strength and dynamic balance and negative correlation between FLLD and hip adductor length, hip flexor length, static balance, pelvic tilt and aerobic fitness in professional athletes.

Keywords: Limb Length Discrepancy (LLD), Pelvic Tilt, Aerobic Fitness, Balance

Background

Injuries in long-distance runners are mainly overuse injuries to the lower extremities. Risk factors may be extrinsic or intrinsic. One of the potential risk factors for running injuries is LLD. (B.W. Jakobsonen et al, 1994). LLD can be subdivided into two etiological groups: a structural LLD (SLLD) defined as those associated with a shortening of bony structures, and a functional LLD (FLLD) defined as those that are a result of altered mechanics of the lower extremities. (Blake RL et al, 1992). There is an association between hip abductor, adductor, and flexor muscle group strength imbalance and lower extremity overuse injuries in runners. (Niemuth PE et al, 2005).

If there is an imbalance in the length-tension relationships and improper dynamic posture during movement, the constant tug of war between muscles can prematurely lead to muscle, joint, tendon and ligament injuries' (Victor Ramano, 2010). LLD of 1 cm could induce a significant postural shift and increase the extent of postural sway. (Mahar et al 1985) Asymmetrical pressure gradient secondary to pelvic tilts as a cause of functional LLD. (Kappler RE , 1983). Both oxygen consumption and the rating of perceived exertion were greater with a 2-cm artificial limb-length discrepancy than they were with no artificial limb-length discrepancy. (Burke Gurney,2001).

Research Question

Is there any difference of hip muscle imbalance, balance, pelvic tilt and aerobic fitness between professional

athletes and recreational athletes having functional limb length discrepancy?

AIMS & OBJECTIVES

To compare the hip muscle imbalance, balance, pelvic tilt and aerobic fitness between professional athletes and recreational athletes having functional limb length discrepancy.

To find correlation between functional limb length discrepancy, hip muscle imbalance, balance, pelvic tilt and aerobic fitness in athletes.

HYPOTHESIS

Experimental hypothesis

There will be significant difference of hip muscle imbalance, balance, pelvic tilt and aerobic fitness between professional athletes and recreational athletes having functional limb length discrepancy

Null hypothesis

There will be no significant difference of hip muscle imbalance, balance, pelvic tilt and aerobic fitness between professional athletes and recreational athletes having functional limb length discrepancy.

Need for the study

Even though the science is out there, very few clinicians have put it all together into a meaningful and effective assessment and treatment algorithm. Therefore, one of my primary objectives in undertaking this study was to connect pieces of somewhat disparate risk factors together in a thoughtful way, illuminating the process from identification of the problem through assessment, through understanding its implications, and finally appreciating there are effective treatment modalities available.

Methodology

POPULATION

Athletes from Delhi Pharmaceutical Sciences and Research University

SAMPLE

A total of 30 subjects were selected who met the selection criteria.

PLACE

The study was conducted in the Research lab, Physiotherapy department of Delhi Pharmaceutical Sciences and research University, New Delhi.

INCLUSION CRITERIA

- Subjects with age 12-22 years
- Subjects having functional LLD
- Subjects who are able to tolerate standing for up to 20 minutes
- Group A include professional athletes from Delhi Pharmaceutical Sciences and research University, New Delhi.
- Group B include recreational athletes from Delhi Pharmaceutical Sciences and research University, New Delhi.

EXCLUSION CRITERIA

- Subjects with BMI above normal
- Structural limb length discrepancy
- Pain;- musculoskeletal, neurological, systemic, post traumatic
- Subject with history of fractures and dislocation of Lower limb, surgery of lower limb
- Vestibular problems
- Visual problems
- Concussion in the 12 weeks before study

DESIGN

- Experimental design – comparative in nature

SAMPLING

- Purposive sampling was done to divide the sample in two groups with 15 subjects in each group

VARIABLES

DEPENDANT VARIABLE

1. Hip muscle strength and length
2. BESS
3. SEBT
4. Inclinometry
5. 20 meter shuttle test

INDEPENDENT VARIABLE

1. Professional athletes
2. Recreational athletes

INSTRUMENTATION

- Inch tape
- Ruler
- Marker pen
- Digital inclinometer
- Strain gauge

- Foam
- Laptop with speakers
- Digital camera
- Stopwatch
- Marking cones

Data Analysis

- Unpaired t-test was done between two groups A and B to compare the hip muscle imbalance, balance, pelvic tilt and aerobic fitness.
- Carl Pearson correlation test was done within the each group, group A and group B, to correlate the the functional limb length discrepancy, hip muscle imbalance, balance pelvic tilt and aerobic fitness
- 0.05 was selected as the significance level.

PROTOCOL

Athletes with age ranging from 12 to 22 years were selected from maharana pratap Sports College, Raipur, Dehradun and from Banda bahadur boy’s hostel, Balawala, Dehradun.

↓
Functional limb length discrepancy was measured by using tape measurement method

↓
30 athletes (mean age 15±1.13 and 19.63±1.22) with functional LLD were selected according to their inclusion and exclusion criteria and they were selected for further study

↓
Consent of the subjects was obtained.

↓
Purposive sampling (15 subjects in each group)

↓
Group A (n=15)
(Mean age = 15± 1.13)

↓
Group B (n=15)
(Mean age 19.73±1.22)

Professional athlete

Recreational athlete

↓
Strength of the abductors and extensors was measured by using strain gauge

↓
Length of hip adductor and hip flexor was measured

↓
Balance was measured

- Static Balance – By using BESS
- Dynamic balance – By using SEBT

↓
Pelvic tilt was measured by using digital inclinometer

↓
Aerobic fitness of both the group was measured by using 20 meter shuttle test

↓
Compare of the hip muscle imbalance, balance, pelvic tilt and aerobic fitness between professional athletes & recreational athletes having functional limb length discrepancy and to find, is there any correlation between FLLD, hip muscle imbalance, balance, pelvic tilt and aerobic fitness in athlete.

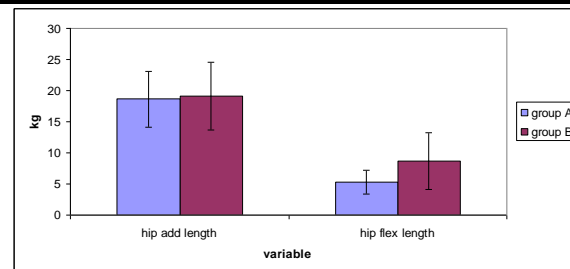
Result

Comparison of mean aerobic fitness, hip abductor strength, hip extensor strength, hip adductor length, hip flexor length between group A & B

COMPARISION OF AEROBIC FITNESS BETWEEN GROUP A AND GROUP B

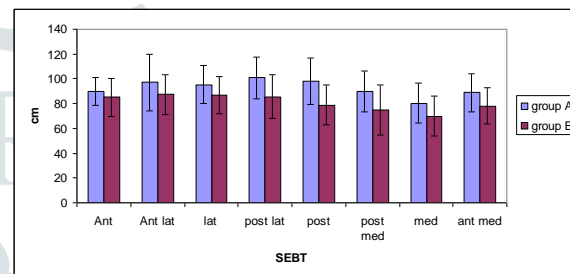
Group	AEROBIC FITNESS	HIP ABD STRENGTH	HIP EXT STRENGTH	HIP ADD LENGTH	HIP FLEXOR LENGTH
A	46.15 ±5.38	9.32 ±2.81	9.55 ±3.52	18.61 ±4.49	5.27 ±1.87
B	39.62 ±4.72	12.03 ±2.68	11.42 ±2.15	19.11 ±5.40	8.71 ±4.56
T value	3.59	-2.74	-1.78	-0.28	-2.75
P value	S	NS	NS	NS	NS

GRP	BESS	SEBT								Pelvic Tilt
		ANT	ANT	LAT	POST	POST	POST	MED	ANT	
			LAT		LAT		MED		MED	
A	15.60± 5.96	89.99± 11.28	97.05± 22.66	95.43± 15.66	100.72± 17.03	98.22± 18.65	89.97± 16.58	80.39± 16.20	88.73± 15.06	8.22± 3.47
B	20.47± 10.02	85.18± 15.26	87.30± 15.99	86.79± 14.77	85.63± 17.36	78.95± 16.35	74.81± 20.28	69.79± 15.94	78.17± 14.41	9.47± 2.41
T - value	-1.62	0.98	1.851	1.57	2.40	3.01	2.24	1.82	1.96	-1.15
P - value	NS	NS	NS	NS	S	S	S	NS	NS	NS

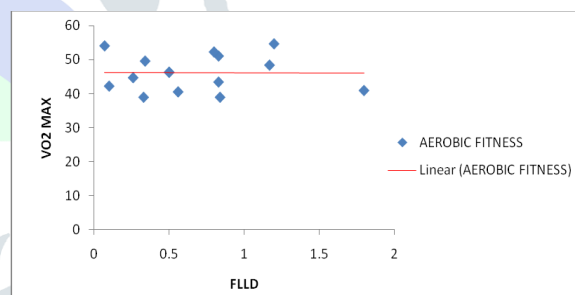


COMPARISON OF MEAN BESS, SEBT AND PELVIC TILT BETWEEN GROUP A & B (Independent t- test)

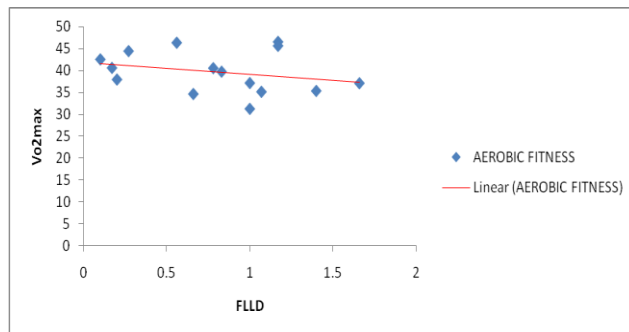
COMPARISON OF SEBT IN DIFFERENT DIRECTIONS BETWEEN GROUP A AND GROUP B



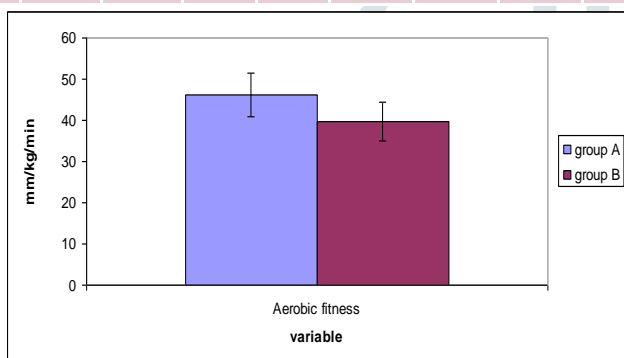
CORRELATION BETWEEN FLLD AND AEROBIC FITNESS IN GROUP A



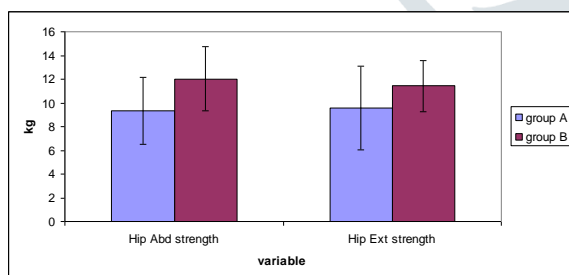
CORRELATION BETWEEN FLLD AND AEROBIC FITNESS IN GROUP B



CORRELATION BETWEEN FUNCTIONAL LIMB LENGTH DISCREPANCY AND DYANAMIC BALANCE



COMPARISON OF HIP ABDUCTOR STRENGTH AND HIP EXTENSORS STRENGTH BETWEEN GROUP A AND GROUP B



COMPARISON OF HIP ADDUCTOR AND HIP FLEXOR LENGTH BETWEEN GROUP A AND GROUP B

GROUP	ANT	ANT LAT	LAT	POST LAT	POST	POST MED	MED	ANT MED
A	0.31	0.30	-0.02	0.22	0.27	0.30	0.30	0.32
B	0.09	0.17	0.13	0.12	-0.005	0.03	0.17	0.28

CORRELATION BETWEEN FUNCTIONAL LIMB LENGTH DISCREPANCY AND AEROBIC FITNESS.

DISCUSSION

For the balance i.e. static balance and dynamic balance, the result showed non significant difference between professional athlete and recreational athletes with FLLD. FLLD leads to alter in both static and dynamic balance in athletes. Functional muscles follow the law of reciprocal inhibition. If one is affected, affects other muscles in chain and hence decrease the efficiency. For pelvic tilt, the result of study showed non significant difference between professional athlete and recreational athletes, which is contradicted by Young et al who found the in nominate contra lateral to the lift rotated anteriorly compared to the ipsilateral side and that lateral flexion of the trunk increased toward the side of the lift. For the aerobic fitness the data obtained from the study showed a significant difference between professional athletes and recreational athletes with FLLD, supported by Delazerda and Mccrory (contradicted by Kern (1995, unpublished data), Red et al (1982, unpublished data).

Professional athletes have more aerobic fitness because of more extensive aerobic trainings than recreational athletes.

Study showed positive correlation between FLLD and strength of hip abductor, hip extensor muscles strength in group A and hip extensors strength, hip adductor length in group B. A negative correlation between FLLD length of hip adductors, hip flexor muscles in group A and hip abductor strength and hip flexor length in group B. professional athletes regularly use stretching exercise program as a warm up and as a cool down session, so it may be the reason why length of the hip adductor and hip flexor muscles is not that much affected.

LIMITATIONS OF THE STUDY

- Study sample size was very small (n = 30)
- Use of the force plate was not possible.
- Use of dynamometer was not possible to measure the strength.
- There was also lack of current studies as the majorities were twelve to twenty two years old

GROUP	CORRELATION VALUE
A	-0.01
B	-0.27

junior level players rather than elite players.

- There was no use of radiographs.

FUTURE SCOPE

In future studies functional limb length discrepancy in athletes can be correlated with:

- Elite athletes with age above 20 years
- Female athletes
- Soccer players
- Correlation of functional limb length discrepancy with EMG activities of lower extremity muscles
- Correlation of functional limb length discrepancy with EMG activities of quadriceps on longer side and plantar flexors on shorter leg.

CLINICAL IMPLICATIONS

Even though the science is out there, very few clinicians have put it all together into a meaningful and effective assessment and treatment algorithm. Therefore, one of my primary objectives in undertaking this study was to connect pieces of somewhat disparate risk factors together in a thoughtful way, illuminating the process from identification of the problem through assessment, through understanding its implications, and finally appreciating there are effective treatment modalities available. And hence it might help physiotherapist, athletes, athletic trainers and coach for the assessment, treatment and feedback. Hence enhancing their fitness level and performance.

CONCLUSION

- It has been concluded that there is a significant difference in aerobic fitness and dynamic balance (in posterolateral, posterior and postero-medial directions) between professional athletes and recreational athletes having FLLD.
- It has been concluded that there is positive correlation between FLLD and hip abductor strength, hip extensor strength and dynamic balance and negative correlation between FLLD and hip adductor length, hip flexor length, static balance, pelvic tilt and aerobic fitness in professional athletes.
- Whereas in recreational athletes, it has been concluded that there is positive correlation between FLLD and hip extensor strength, hip adductor length, static balance and dynamic balance and negative correlation between FLLD and hip abductor strength, hip flexor length, pelvic tilt and aerobic fitness.

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