Foot Arch and Posture stability in Sports Aerobics Athletes

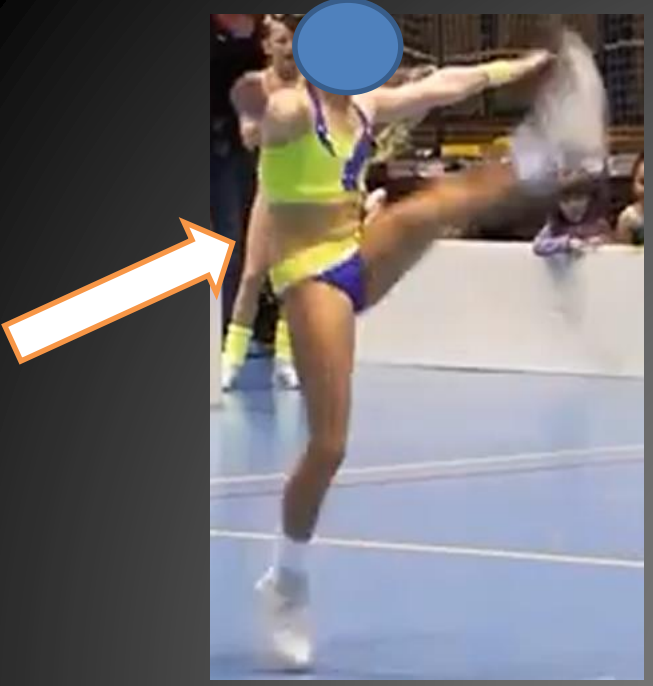
PhDr. Ivana Vláčilová, Ph.D.
Department of Physiotherapy, Charles University, FTVS, Prague

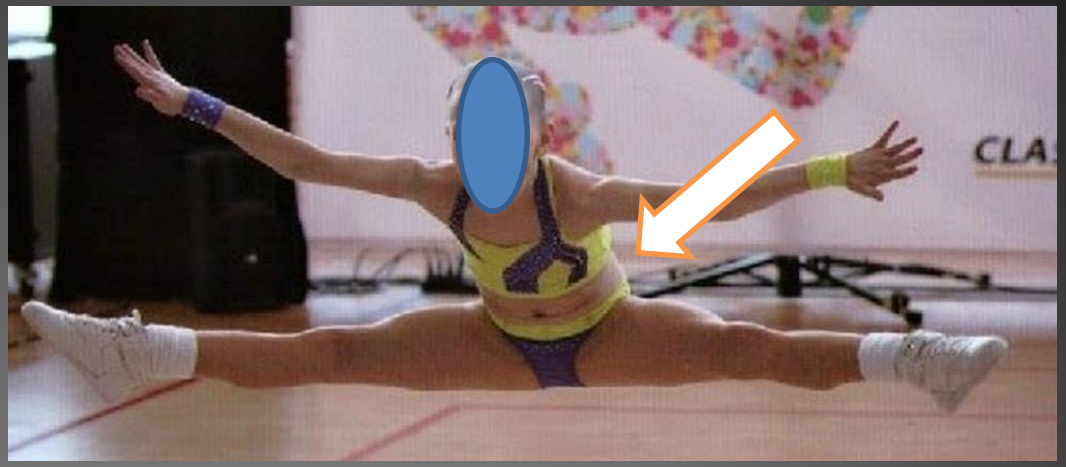
Sports Aerobics

- **High** demands on girls and trainers
- **High** motivation to reach master level (*the pressure of ambitious parents!)*
- **High** speed music

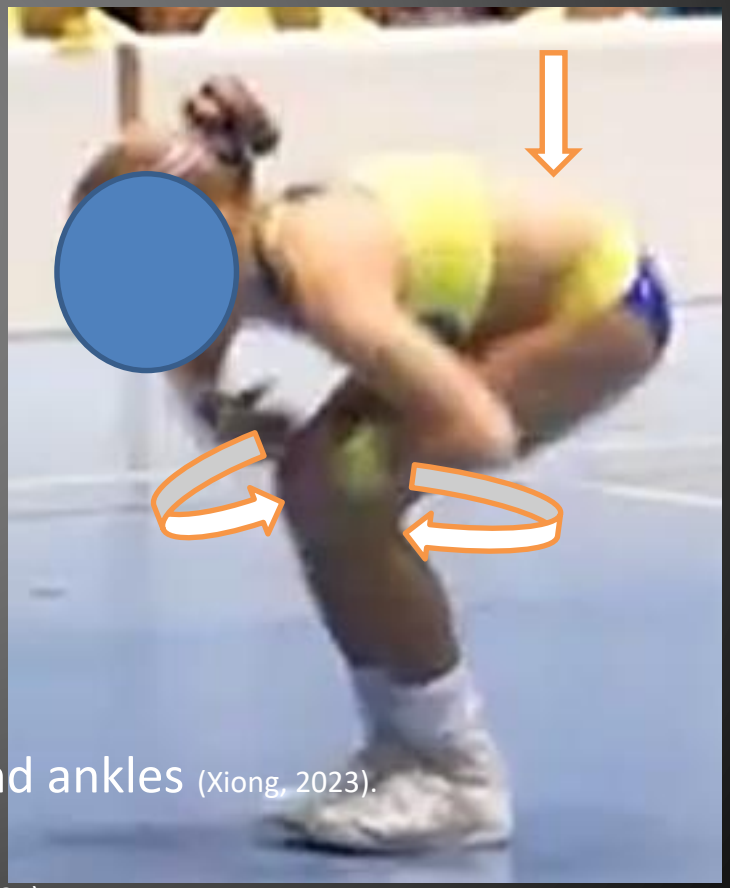
  Girls often fail to match movement with the fast music, leading to incorrect movement patterns, which negatively impacts their health.

- **The principles of health-oriented strength building are forgotten in training!**





Faulty movement patterns



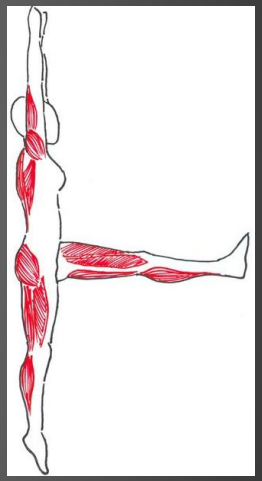
- **The most common INJURIES**:
shoulders, elbows, wrists, waist, thighs, knees and ankles (Xiong, 2023).

- The most prone to injury is the ankle joint (Zhu, 2021)

Study Objective

- Aerobics is a bipedal locomotion activity from a kinesiology perspective.

- Spine Stabilization is necessary !



(Bernacikova et al, 2012)

- *The foot is part of the stabilization system because standing upright relies on the internal muscles of the foot!*

Study Hypothesis

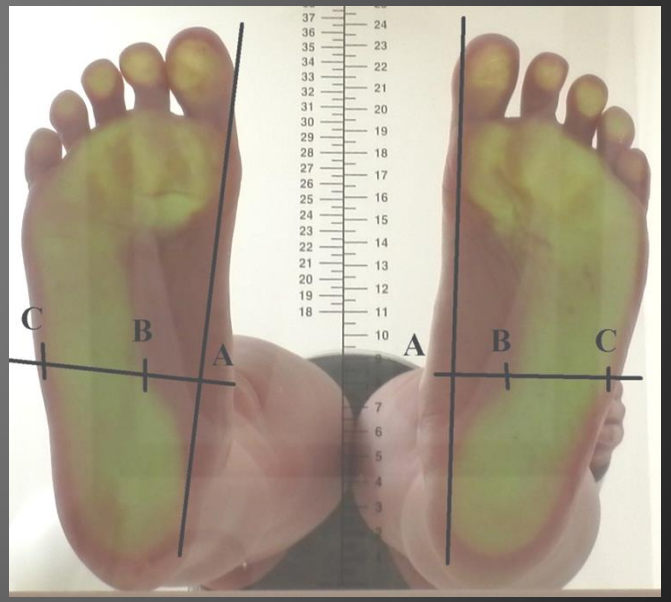
- The **OBJECTIVE** of this study was to describe the relationship between the ability to stabilize the trunk and the functional status of the foot.

- The **HYPOTHESIS** was that decompensation of one body part (especially trunk stabilization) leads to insufficiency of the whole system, which will be reflected in the foot arch.

Methodology

- **14 girls** (age 11 ± 2,5) competitive level AE
- Musculoskeletal pain ???

- Podoscope



Evaluation with **Sztriter – Godunov index**

- Low arched foot 0,46 - 1,00
- Neutral arched foot 0,26 – 0,45
- High arched foot 0,00 - 0,25

index i = B – C / A – C

Hip Flexion Test

(Kolář, 2010)

- *The most common movement patterns of AE are kicks, walking, running, forefoot …*

Evaluation:

(Kolář, 2010)

- 0 No compensatory movements of spine/pelvis
- 1 Pelvic rotation to the flexed hip
- 2 Compensatory lateral deviation of THL spine
- 3 Lordotization of the L spine
- 4 Kyphotization of the L spine

Physiotherapy Care

- Exercises based on developmental kinesiology

  5 months / 1x every 14 days under the supervision of a physiotherapist

  Re-Examination

Initial data Control

subject	Foot index Right	Foot index Left	Hip F Right	Hip F Left	Foot index Right	Foot index Left	Hip F Right	Hip F Left
1	0,16	0	0	4	0,2	0	2	2
2	0	0,2	4	2	0,23	0,34	0	2
3	0	0	1	4	0	0	2	2
4	0	0	4	4	0,27	0,25	0	0
5	0,3	0	1	4	0,28	0,21	2	0
6	0	0	2	4	0,13	0	0	1
7	0	0,35	2	4	0,27	0,28	2	2
8	0	0	1	2	0,2	0,21	1	0
9	0	0	4	4	0	0	1	0
10	0,2	0,27	0	1	0,31	0,28	0	1
11	0,17	0,22	1	0	0,17	0,22	1	0
12	0,34	0,3	0	1	0,35	0,31	0	0
13	0,35	0,35	1	0	0,36	0,36	1	0
14	0,37	0,39	2	0	0,37	0,39	2	0

Results – Initial data

Foot Arches:

High arched foot: 64%
(0.13 ± 0.01 right; 0.14 ± 0.01 left)

Hip Flexion Test:

Kyphotization of the lumbar spine (57%)

Pain Incidence:

- Knee pain (50%)
- Groin pain (28.5%)
- Achilles tendon pain (14.2%)

Girls with healthy feet stabilized the trunk better.

T test (p = 0,01) right / left

Foot index at girls with normally and high arched foot

T test (p = 0,01) left

Difference in the Quality of spinal stabilization

- Pearson r = - 0,53 right
- Pearson r = - 0,73 left

Correlation between foot index and hip flexion test

Re-Examination after PT Care

- **Improvement in foot index**

  (0,22 ± 0,1 vpravo, 0,2 ± 0,1 vlevo)

  - T test (p = 0,01) right foot

- **Improvement in trunk stability**

  No girls exhibited kyphotization of lumbar spine

  - T test (p = 0,01) Test hip flexion left

- **Pain Incidence:**

  Knee pain persisted in only 2 girls

Discussion

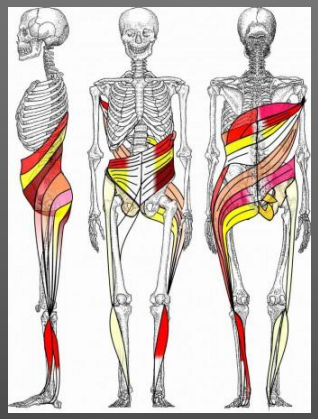
- **Podoscope and Foot Index Assessment:**
  - is valuable tool in clinical practice
  - Staheli (SI), Chippaux-Smirak (CSI), and Sztriter-Godunow (KY) indices are highly correlated ($\rho > 0.84$, $p < 0.001$) and reliable for assessing the longitudinal foot arch (Szczepanowska et al. 2021).

- **Clinical Caution:**
  - Not every high arched foot is an orthopedic deformity (pes excavatus)
    - **Beware of the evaluation in clinical practice !!!**
    - It could be an altered functional state of the foot!

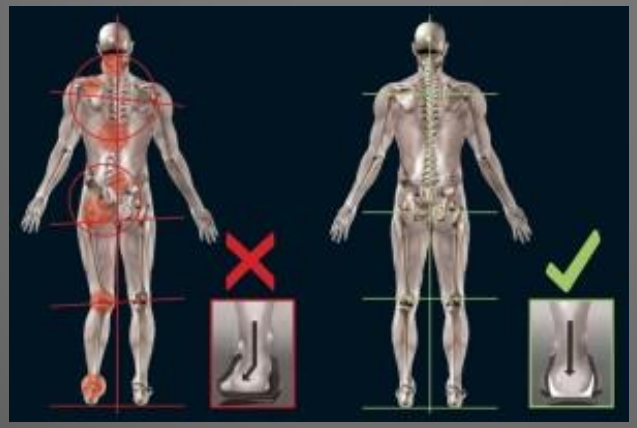
- **Reliability of the hip flexion test**
  - good Inter- and Intra-rater reliability
  - pelvic rotation is the most easily detectable by the examiner (90%), followed by trunk extension and lateralization of the thoracolumbar spine (70-90%). (Voráčová, 2011)

- **The compensatory exercises**

  - improvement in oblique abdominal chains
  - Significant improvement in left hip flexion test and right leg index.
  - **No lumbar spine kyphotization was observed in any of the girls.**



- **Impact on Knee Pain:**
  - High arched feet lead to knee pain.
  - Poor foot alignment affects knee and hip biomechanics, leading to compensatory mechanisms in the pelvis and spine.
    - Tibialis posterior tendinopathy is associated with decreased proximal muscle strength, including the hip extensors and abductors (Rao et al., 2012).



- **Posture Impact:**
  - High arched feet significantly affect plantar pressure distribution and posture, causing asymmetry in the shoulder girdle and altering limb load distribution (Woźniacka et al. 2019).
  - Abnormal foot structures can cause compensatory changes in posture and movement patterns, affecting trunk stability (Rao et al. 2012).

- *This study shows a high correlation between foot index and trunk stability!*

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Ankle Stability and Movement Coordination Impairments: Lateral Ankle Ligament Sprains Revision

Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Academy of Orthopaedic Physical Therapy of the American Physical Therapy Association

AUTHORS

Journal of Orthopaedic & Sports Physical Therapy
Published Online: March 31, 2021 | Volume 51 Issue 4 | Pages CPG1-CPG80
https://www.jospt.org/doi/10.2519/jospt.2021.0302

- The most prone to injury is the ankle joint (Zhu, 2021)

FPI would be positive

Female sex as a risk factor
Younger age was associated with increased risk
Foot Posture Index (FPI) is associated with risk
Participating in sports

Summary of Recommendations

- -Foot examination (Grade A) - Clinicians should use validated patient-reported outcome measures such as pain scales, Foot and Ankle Ability Measure, and Lower Extremity Functional Scale as part of the standard clinical examination. Clinicians should use these before and after applying interventions designed to alleviate impairments in body function and structure...

- -Intervention (Grade C) – for primary prevention balance training exercises, (Grade A) later in prevention stretching exercises, neuromuscular training, postural re-education

Conclusion

- This study shows that high arched foot is not only a fixed orthopaedic deformity, but may be related to impaired trunk stability.
- The study highlights the **importance of physiotherapy care** in sports aerobics.

Thank you for Attantion

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