XXVII International Conference of Sport Rehabilitation and Traumatology
Football Medicine Outcomes – Are We Winning? Barcelona, Spain June 2018

Hamstrings Muscles Volume of Elite Football Athletes assessed using Magnetic Resonance Imaging

Firmino, T.; Santos, F.; Abrantes, F.; Til Perez, L.; Mascarenhas, V.; Mendes, B.; Vaz, J.R.; Oliveira, R.; Martins, A.; Freitas, S.

Telmo Firmino, PT BSc

Sport Lisboa e Benfica
Human Performance Department - Health and Performance

Faculty of Human Kinetics, University of Lisbon
Laboratory of Motor Behaviour

Alcoitão School of Health Sciences
Physiotherapy Department

What do We Know?

Acta Physiol Scand 2001, **172**, 249–255

Muscle volume is a major determinant of joint torque in humans

T. FUKUNAGA, M. MIYATANI, M. TACHI, M. KOUZAKI, Y. KAWAKAMI and H. KANEHISA

Department of Life Sciences, University of Tokyo, Tokyo, Japan

Hamstring Volume → **Hamstring Strength**

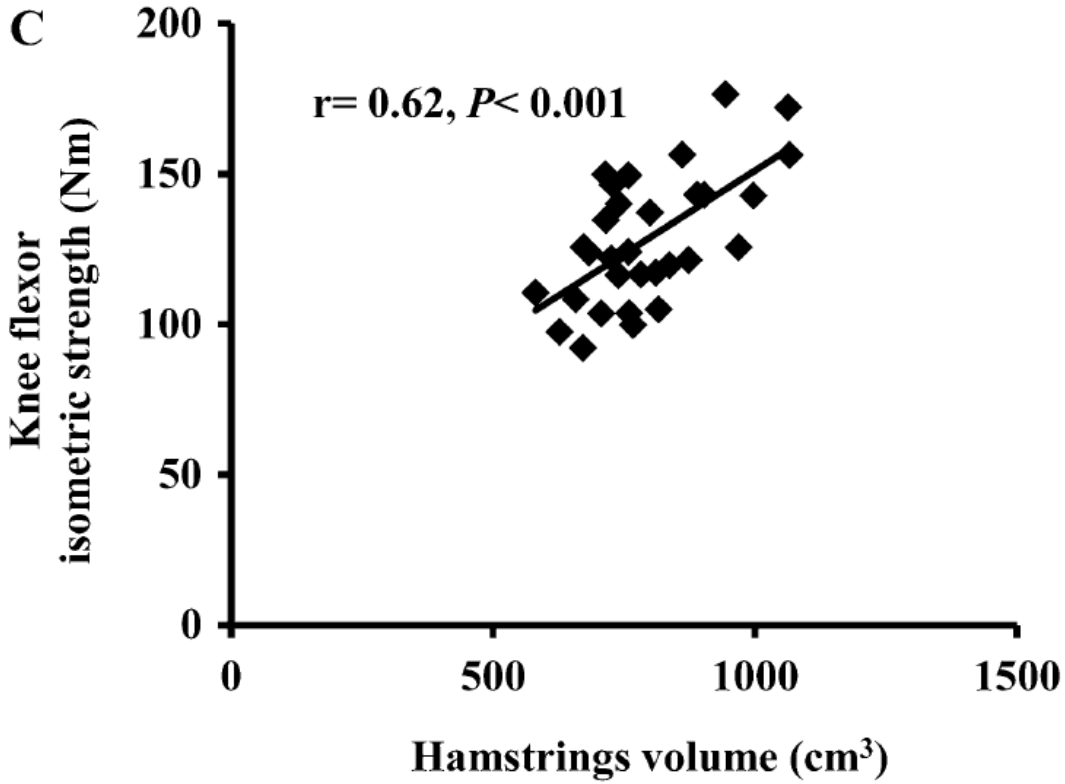
What do We Know?

Eur J Appl Physiol
DOI 10.1007/s00421-015-3321-7

ORIGINAL ARTICLE

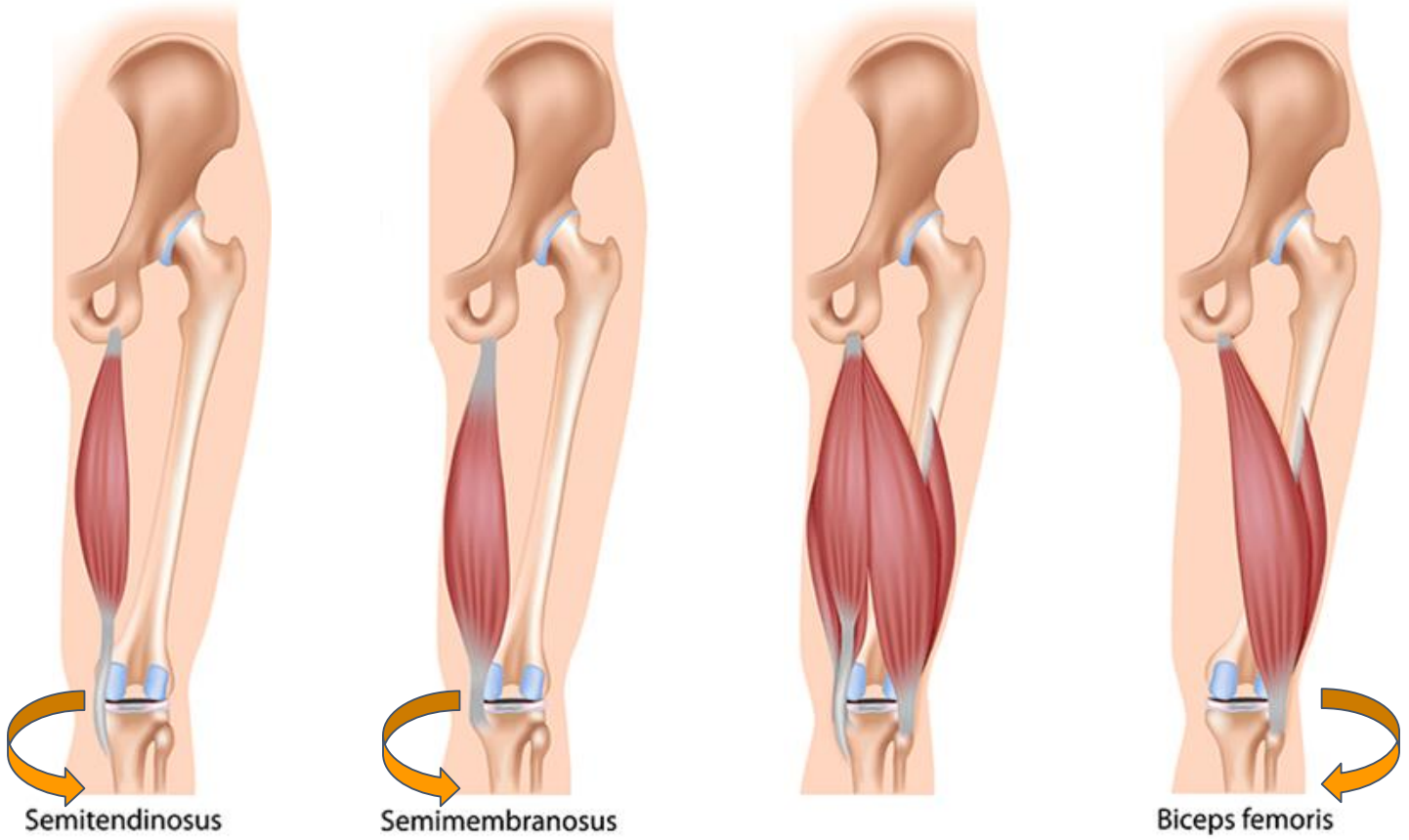
Strength and size relationships of the quadriceps and hamstrings with special reference to reciprocal muscle balance

Pavlos E. Evangelidis[1] · Garry J. Massey[1] · Matthew T. G. Pain[1] · Jonathan P. Folland[1]



Hamstring Volume → **Hamstring Strength**

What do We Know?



Hamstring **Volume** → **Hamstring** **Strength** → **Knee** **Motions?**

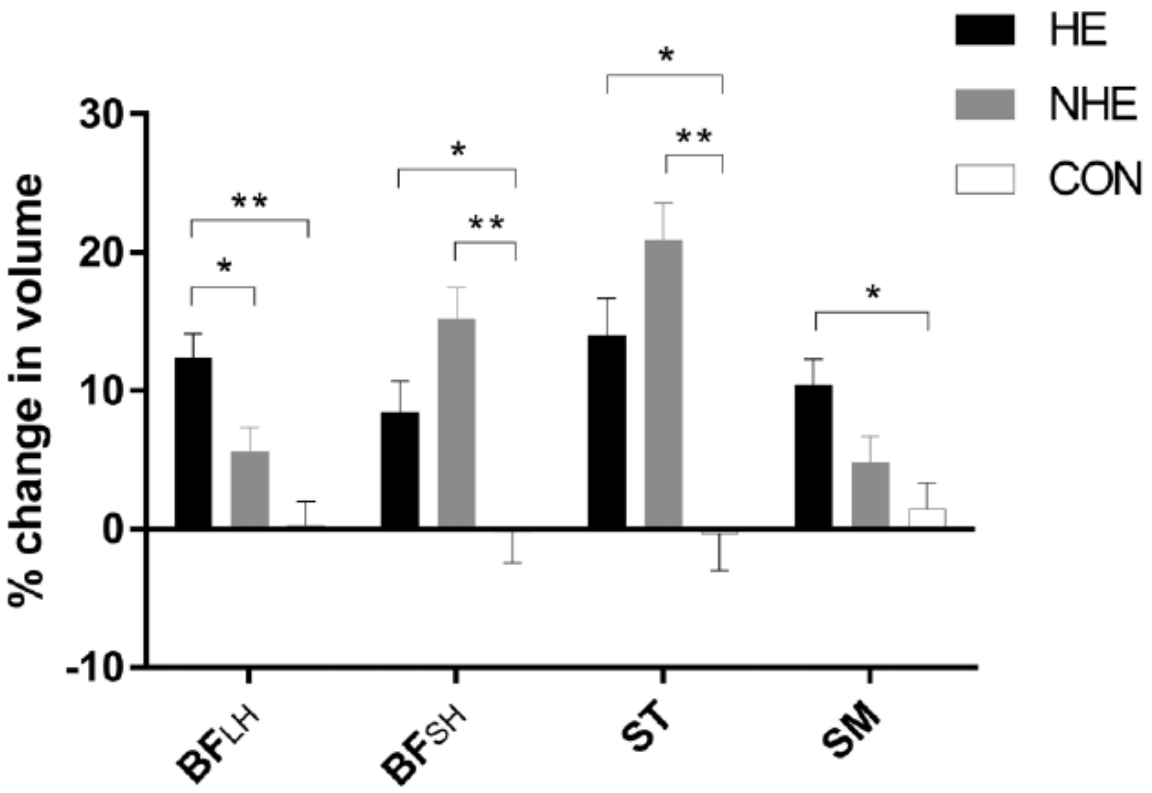
What do We Know?

The volumetric pattern can be changed:

↠ **Training**

↑

Hamstring Volume



Bourne et al. (2017). Br J Sports Med. 51(5):469-477

What do We Know?

The volumetric pattern can be changed:

- ↠ Training
- ↠ **Injury**

Reflecting neuromuscular inhibition (Silder et al, 2008; Fyfe et al 2013)

↑

Hamstring Volume

What do We Know?

The volumetric pattern can be changed:

- ↠ Training
- ↠ Injury
- ↠ **Football practice?**

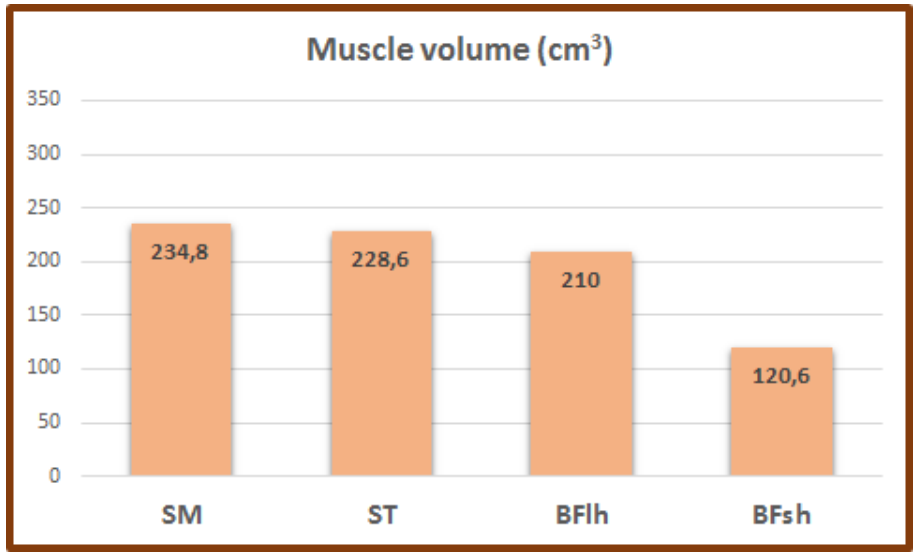
↑

Hamstring Volume

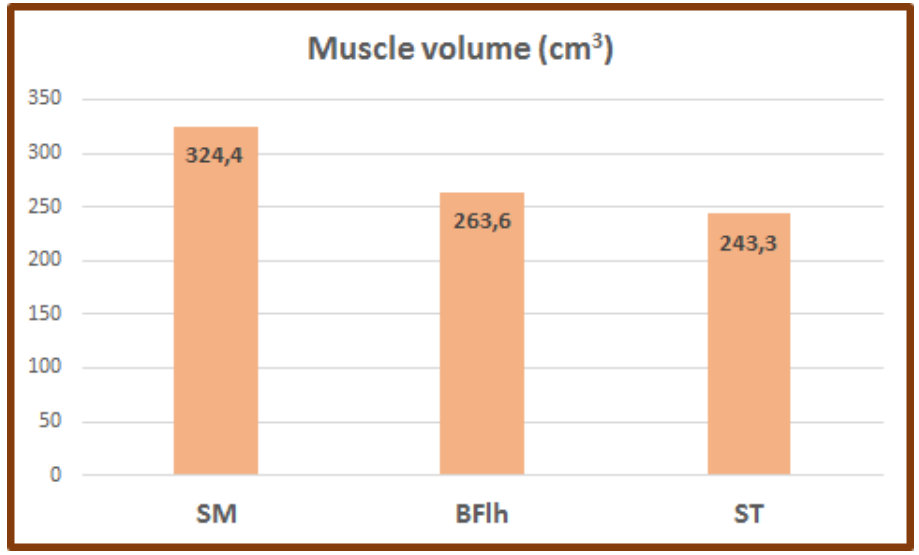
What do We Know?

Which hamstring volumetric pattern is described in literature?

Hamstring Volume



Evangelidis et al. (2017).
Scand J Med Sci Sports. 27(11):1181-1189



Storey et al. (2016).
Scand J Med Sci Sports. 6(12):1480-1489.

Question

Does elite football athletes have a specific hamstring volumetric pattern?

Methods

Participants

n= 10, elite football athletes (26.6±7.0yrs; 75.6±8.9kg; 180.0±8.9cm) assessed in the 2017/2018 pre-season.

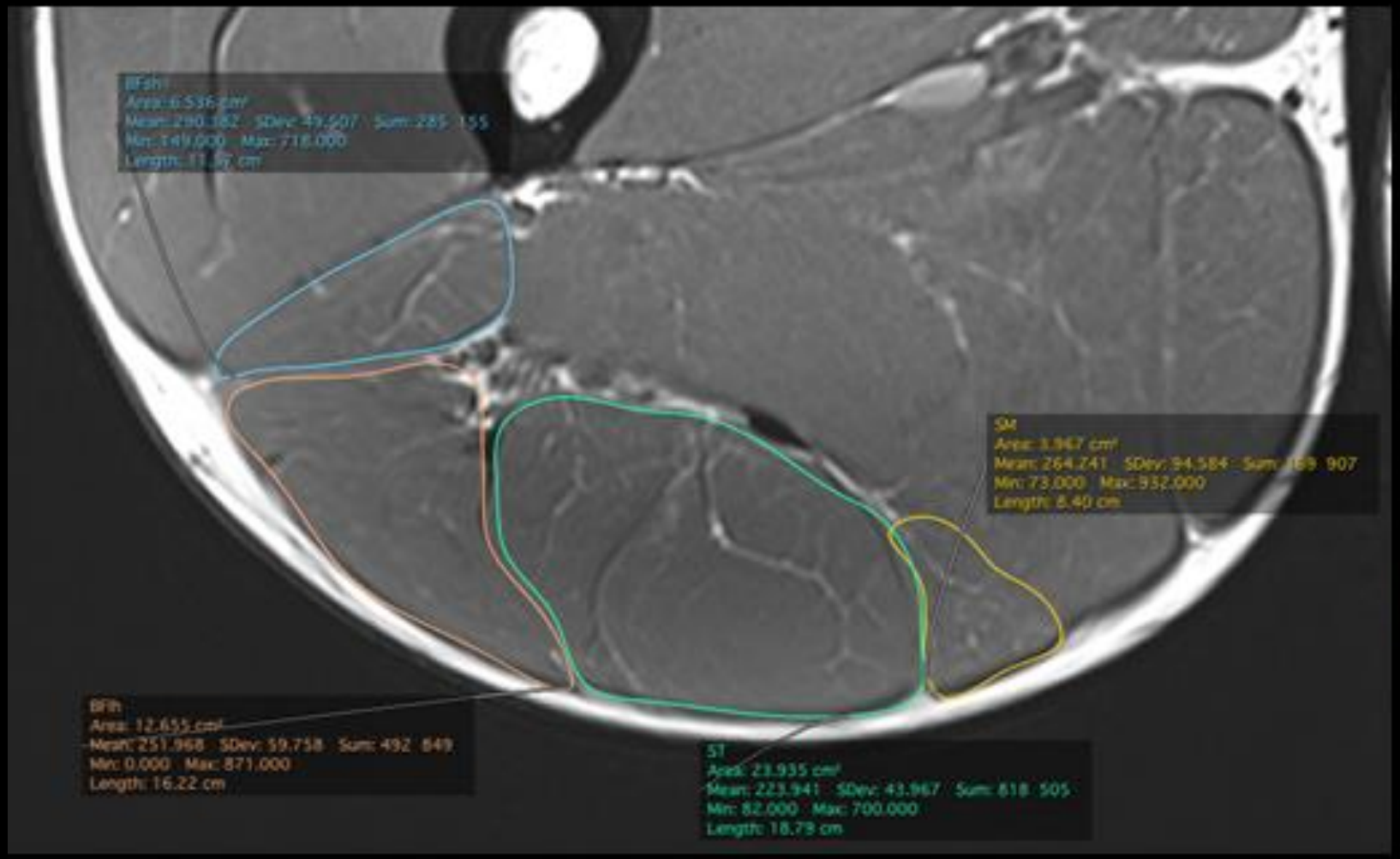
Protocol

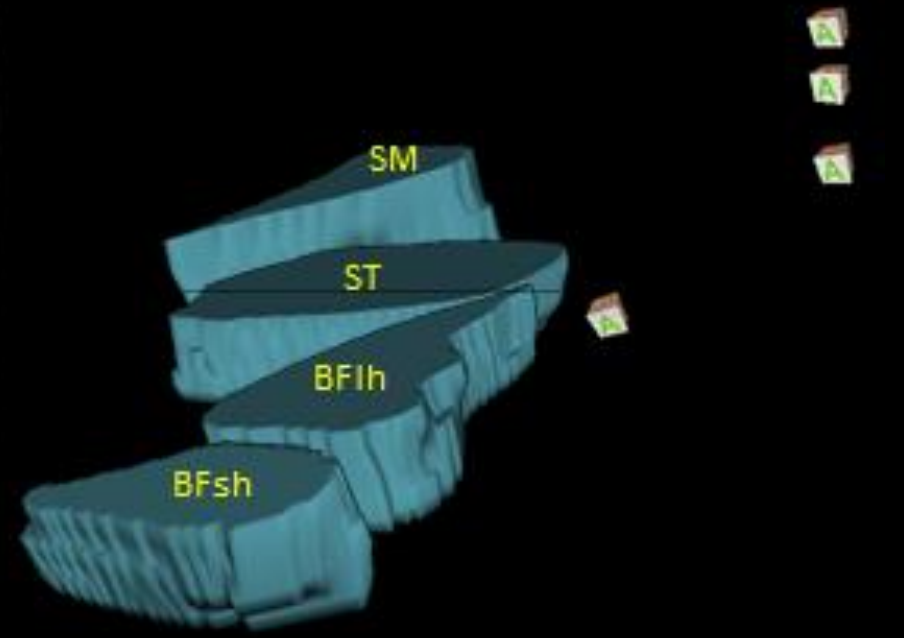
- Participants were positioned in ventral decubitus position

- MRI machine (Siemens Avanto, 1.5 Tesla, Erlangen, Germany).

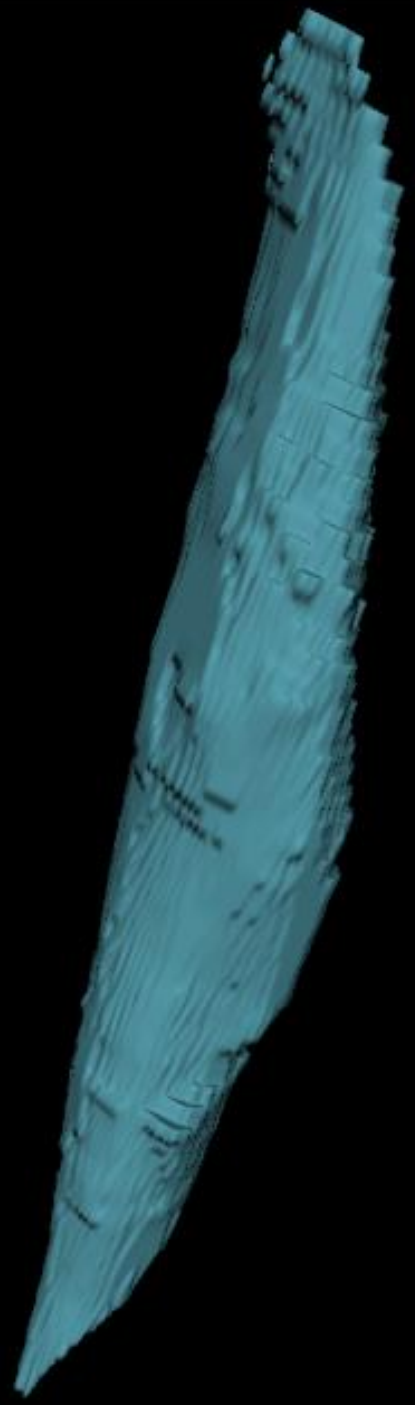
- T1-weighted non-fat suppressed axial plane images:
  - From the anterior superior iliac spine to the knee joint space.
  - Imaging matrix, 512 x 512; field of view, 260 mm x 260 mm; spatial resolution, 0.508 mm x 0.508 mm; slice thickness, 5 mm; and interslice gap, 0 mm.

- Image processing were performed by an experienced and blinded rater, using the Osirix software


BFsh
Area: 6.536 cm²
Mean: 290.382 SDev: 49.607 Sum: 285 155
Min: 149.000 Max: 718.000
Length: 11.37 cm
SM
Area: 3.867 cm²
Mean: 264.241 SDev: 94.584 Sum: 169 907
Min: 73.000 Max: 932.000
Length: 8.40 cm
BFlh
Area: 12.655 cm²
Mean: 251.968 SDev: 59.758 Sum: 492 849
Min: 0.000 Max: 871.000
Length: 16.22 cm
ST
Area: 23.935 cm²
Mean: 223.941 SDev: 43.967 Sum: 818 505
Min: 82.000 Max: 700.000
Length: 18.78 cm


SM
ST
BFlh
BFsh

Example for Semitendinous



Example for Semitendinous

Methods

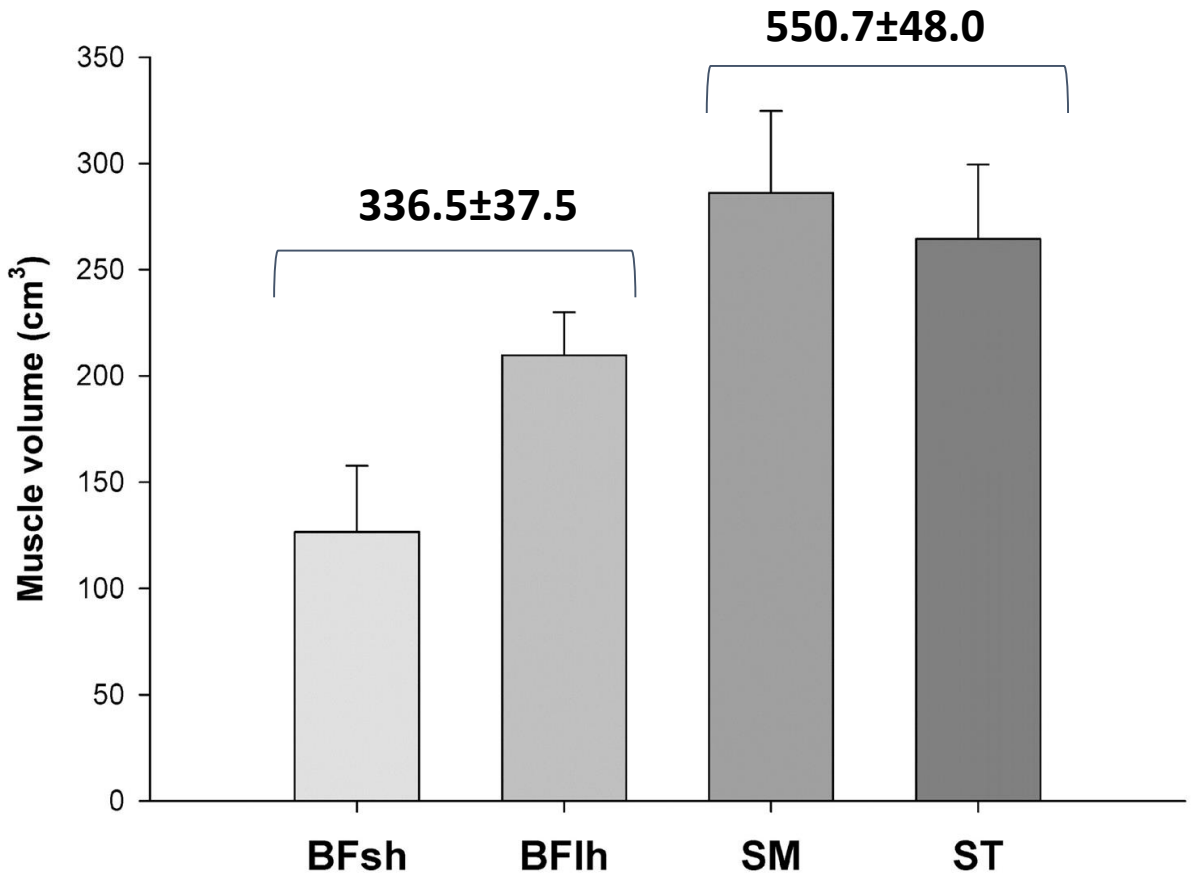
Statistical analysis

- Normal distribution was confirmed with the Shapiro-Wilk test;
- One-way ANOVA repeated measures was performed to determine where differences existed between the hamstring muscles; Post-hoc was performed with the Bonferroni test;
- The effect size (Cohen d) was calculated to provide clinical meaningfulness of the muscles differences;
- Significance was set at 0.05.

Results

Lateral vs. Medial hamstrings volume

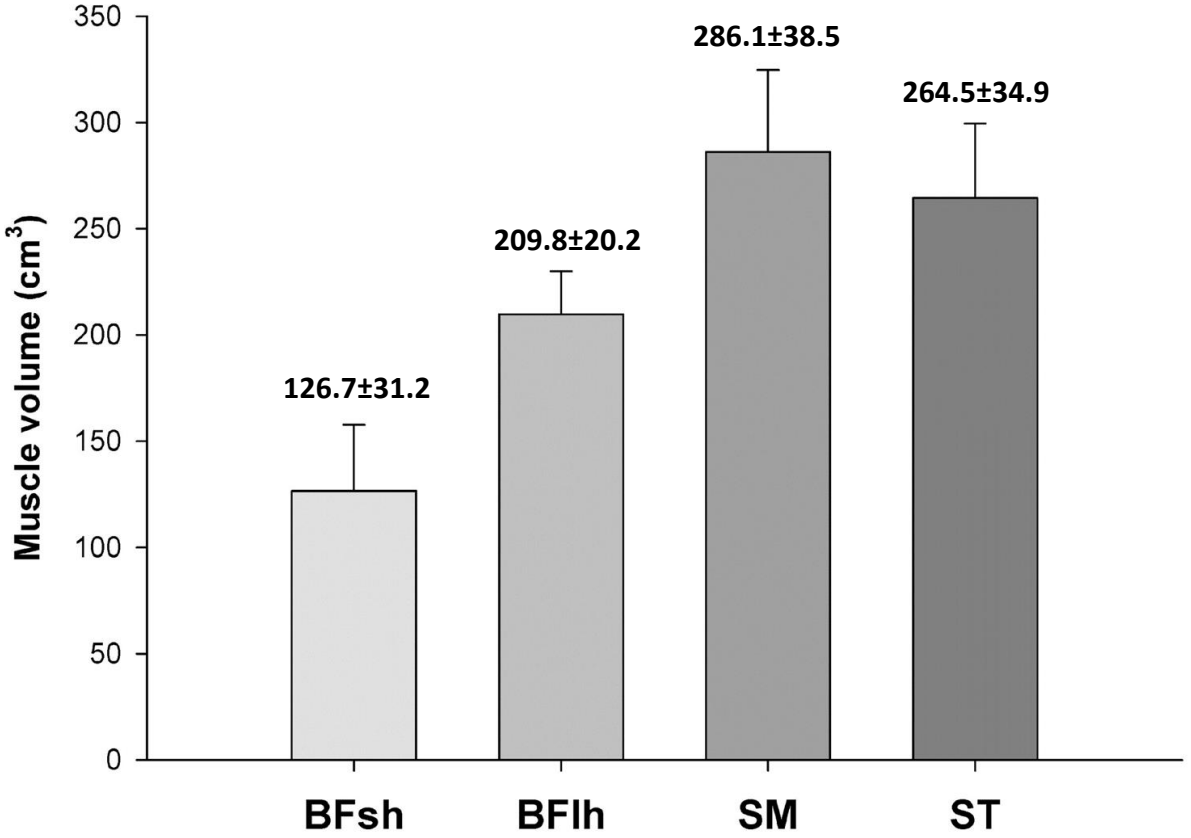
mean ± standard deviation



Results

Individual hamstrings muscle volume.

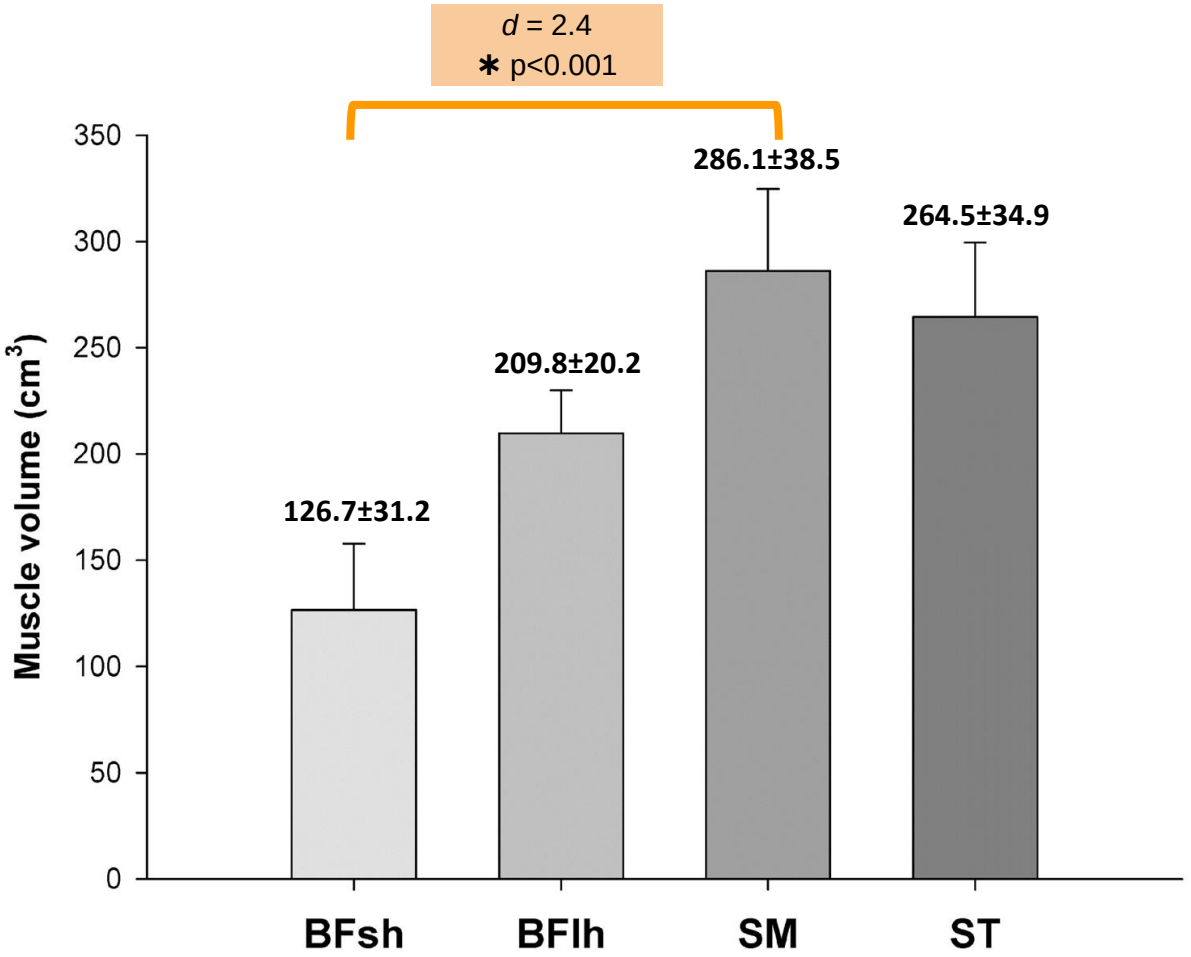
mean ± standard deviation



Results

Individual hamstrings muscle volume.

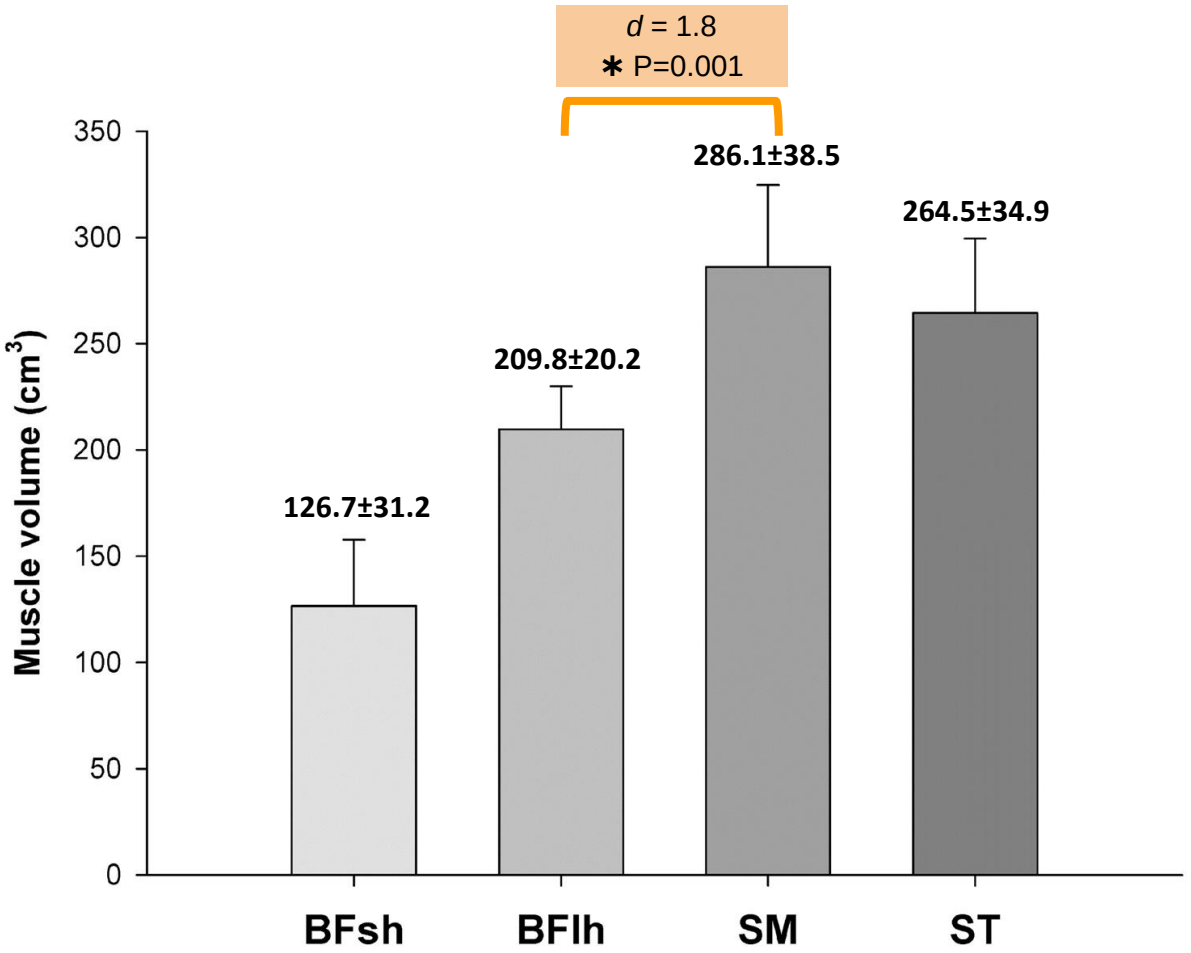
mean ± standard deviation



Results

Individual hamstrings muscle volume.

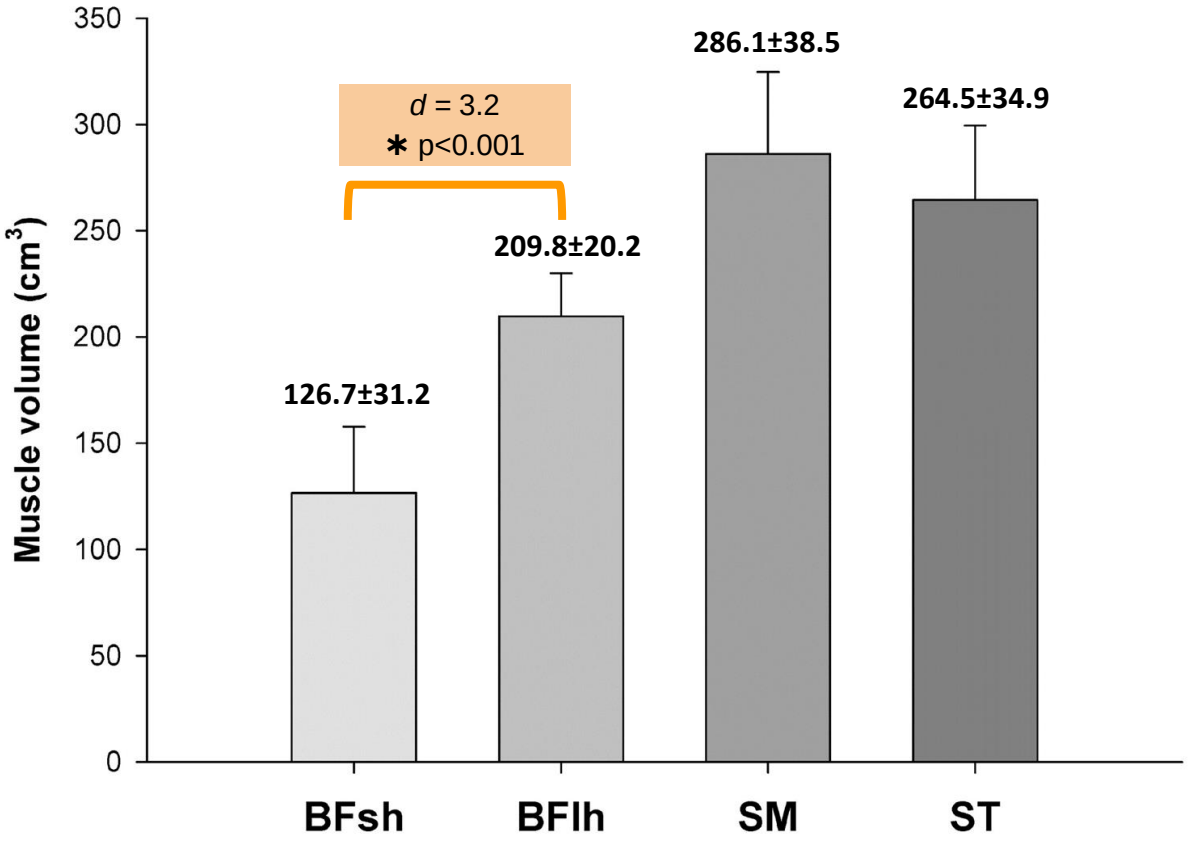
mean ± standard deviation



Results

Individual hamstrings muscle volume.

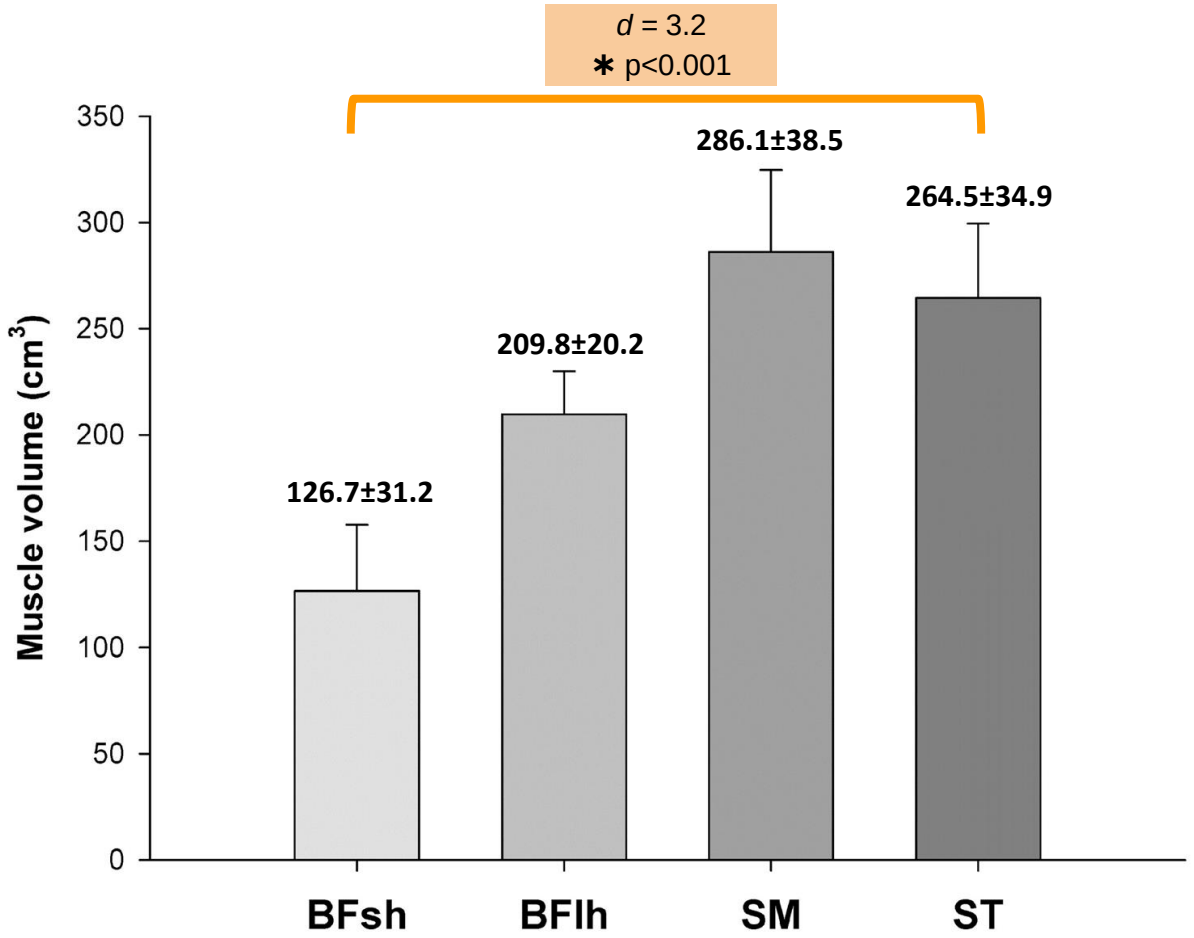
mean ± standard deviation



Results

Individual hamstrings muscle volume.

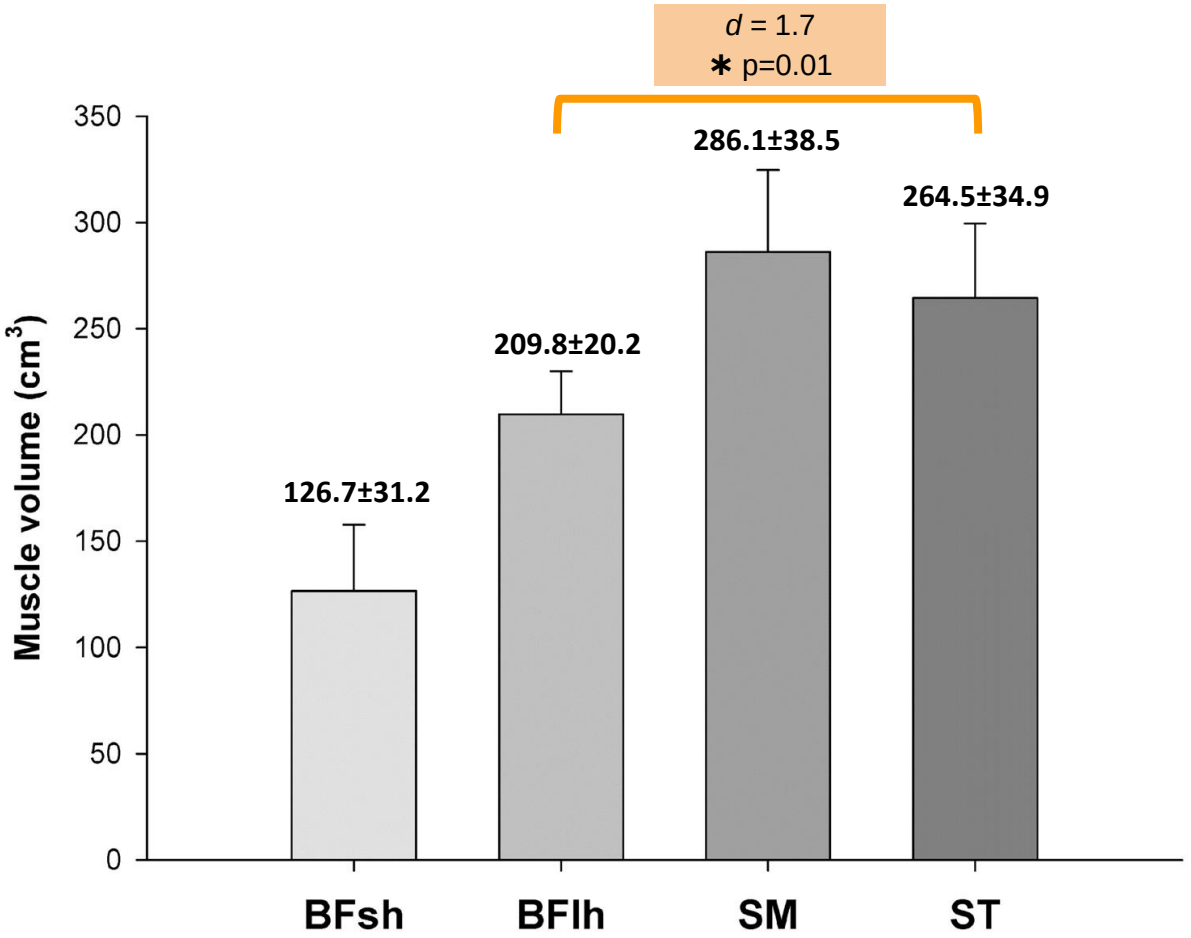
mean ± standard deviation



Results

Individual hamstrings muscle volume.

mean ± standard deviation



Discussion

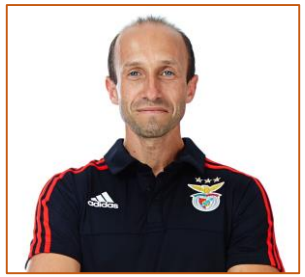
Different individual volumetric pattern from previous reported literature by *Storey et al* (2015) but in line with *Evangelidis et al* (2016);

ST showed a considerable greater volume (d=3.2) than BFlh, which decreased the BFlh/ST volume ratio compared to previous studies;

We speculate that football specific physical activity may induce selective hypertrophy within the hamstring muscles

The present data should be considered in future studies, in particular those aiming to examine the relation between the hamstring volumetric pattern and injury conditions (e.g. hamstring strain injury)

Our Team



Telmo Firmino

Sandro R. Freitas

Bruno Mendes

João R. Vaz

Raúl Oliveira

Tiago Neto