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How Muscle Activity Changes After Six Months of the FIFA 11+ Program?

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Summary:
Five collegial male soccer players performed the FIFA 11+ program for 6 months. Positron emission tomography-computed tomography images showed changes in glucose uptake related to muscle activity in the core muscles. Moreover, the muscle strength of the knee flexion was found to be increased; however, the postural sway was not improved

Abstract:
INTRODUCTION
Prevention of sports injuries is a key concern in sports medicine. Most sports injury prevention training programs include a combination of plyometric, balance, and agility exercises. A recent study indicated that the Fédération Internationale de Football Association's 11+ program (the 11+) is effective in reducing injuries by 30–50% in teams practicing it at least twice a week. However, the skeletal muscle metabolism changes, and the relationship between dynamic/static balance and skeletal muscle in response to activities associated with routinely performing the 11+ are currently unknown. Thus, this study investigated the changes in whole body muscle activity, muscle strength of the lower extremities, and dynamic/static balance following 6 months of performing the 11+.

PURPOSE
To investigate the effects on muscle activity and strength, and on the dynamic/static balance of collegial male soccer players after performing the 11+ for 6 months.

METHODS
Five collegial male soccer players performed the 11+ for 20 min before 37 MBq of 18F-fluorodeoxyglucose (FDG) was injected intravenously. Subsequently, the 11+ was performed for another 20 min followed by 25 min of rest in a sitting position. Positron emission tomography-computed tomography (PET-CT) images were obtained 50 min after FDG injection.

The subjects were instructed to perform the 11+ five times per week for 6 consecutive months, after which another set of PET-CT images were obtained using the same procedure.

Regions of interest were defined within 30 muscles. The standardized uptake value (SUV) of FDG by muscle tissue per unit volume was calculated, and results of the first and second PET-CTs were compared for FDG accumulation.

Muscle strength was quantitatively measured using a Biodex system 4 isokinetic dynamometer. We measured the extension and flexion force of the knee, and the abductor force of the hip.
Postural dynamic balance was evaluated using the Star Excursion Balance Test.
Postural static balance was evaluated using a gravicorder. Postural sway was measured for 60 s during a two-legged stance with eyes open and closed, and 60 s during a one-legged stance with eyes open, before and after the 6-month period.

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RESULTS

The mean SUVs were as follows (before vs. after training, respectively): sartorius (0.69±0.14 vs. 0.91±0.28), gracilis (1.25±0.46 vs. 1.47±0.58), semitendinosus (1.14±0.34 vs. 1.44±0.56), abdominal external oblique (0.56±0.03 vs. 0.91±0.36), gluteus medius (1.89±0.87 vs. 2.82±0.99). The extension and flexion force of the knee, and the abductor force of the hip appeared to show improvement. Especially, for the flexion force of the knee, the dominant side improved from 94.1±13.6 to 98.2±8.9 N/m, and the non-dominant side improved from 85.0±12.4 to 101.4±11.0 N/m. Furthermore, the hamstrings/quadriceps ratio also improved: the dominant side changed from 0.48±0.04 to 0.52±0.06, and the non-dominant side changed from 0.46 ±0.11 to 0.51±0.10. Conversely, there was no significant difference between the post- and pre-training dynamic/static balance.

CONCLUSION

Routinely performing the 11+ for 6 months changed glucose uptake related to muscle activity in the core muscles, hamstrings, gluteal muscles. Moreover, the muscle strength of the knee flexion was found to be increased; however, the postural sway was not improved.