

# Performance aspects of an injury prevention program

## A 10 week intervention with F-MARC 11 in adolescent female football players

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### Introduction

Football has during the last two decades of the twentieth century rapidly increased in popularity among women, both in Scandinavia and in the rest of the world. Epidemiologic studies among Swedish female elite and amateur players have shown that female players sustain as many injuries as males (1, 2). These studies illustrate the high exposure of the lower extremities to injuries in football and emphasize the need for prevention of injuries in football. However, prevention training oriented towards reducing injuries in female athletes may have low compliance rates. Without performance-enhancing effects of the training program, athletes may not be sufficiently motivated to participate. Hence, if protocols were designed to focus on performance, but incorporated proven injury prevention strategies, combined prevention training and performance could be instituted on a wide spread basis with higher athlete compliance (3). A specific training program, called F-MARC 11, has recently been designed by an expert group within the FIFA Medical Assessment Research Centre (F-MARC) in order to prevent the four most common injury types in football, i.e. injuries to the ankle, knee, groin and hamstrings. This 15 min warm-up program is developed on the basis of established principles for rehabilitation of such injuries and includes a total of ten exercises: to exercises for core stability, four exercises for static and three for dynamic balance, and one for lower extremity hamstrings strength (figure 1).

### Aims

The main aim was to measure the potential effect of a 10 week intervention with F-MARC 11 on a battery of performance tests in female youth football players.

### Methods

33 female junior football players (age 16 to 18 yrs), representing two sports high schools, participated in the study. The players were randomly assigned, stratified by school, to either a training group (n=18) or a control group (n=15). The training group used the F-MARC 11 program three times weekly as a warm-up for football training over a 10-week period during the second half of the season. The control group warmed up as usual with ball-based technical exercises. All training was supervised and registered. Performance tests before and after the intervention period included isokinetic and isometric strength protocols for the quadriceps and hamstrings (figure 2), isometric hip adduction and abduction strength, vertical jump tests, 40 m sprint, and football skill tests (shuttle run, long distance kick). The results were analyzed using a two-way (time, group) ANOVA.



Figure 1. Eccentric hamstrings training



Figure 2. Isokinetic strength testing

### Results

The intervention group completed a maximum of 30 training sessions of F-MARC 11 during the 10 week intervention period with a mean completion of 22±10 sessions. Of the 33 girls starting the study, 2 dropped out for reasons unrelated to the study. There were no significant differences observed in performance on the variables tested between the intervention and a control group (table 1).

### Discussion

There are at least five potential explanations for the failure of the program to enhance performance in the intervention group. First, it may be that the test battery chosen was not well enough suited to evaluate the potential improvements in performance. Second, the players may not have been able to reproduce an increase in performance well enough in the test situation due to poor technique. Third, the players may not have been sufficiently motivated to do both the training and the tests, so that they did not perform at their top level. Fourth, the post-tests were done three to five weeks after the end of the competitive season, which may have influenced the physical condition of the players on the test day. Fifth, there are also methodological considerations that need to be addressed. The sample size was too small to detect small differences in change values between the two groups.

### Conclusions

We could not detect any advantages in using a 10 week F-MARC 11 program over regular warm-up exercises in a group of adolescent females, even if we observed an apparent improvement in the intensity and performance of the exercises themselves during the training period.

### References

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Table 1. Pre-test and change results ( $\Delta$ , mean  $\pm$  SD) and between group differences ( $\Delta$ , mean  $\pm$  95% CI)

Tests	Intervention group (n=17)		Control group (n=14)		Between group $\Delta$ (95% CI)
	Pre-test	$\Delta$	Pre-test	$\Delta$	
<i>Dynamic (concentric, eccentric) leg strength</i>					
Q con 60° s <sup>-1</sup> (Nm)	141.0 (17.3)	3.1 (11.8)	142.3 (16.9)	1.6 (10.3)	1.5 (-6.7, 9.8)
Q ecc 60° s <sup>-1</sup> (Nm)	186.8 (19.9)	4.1 (20.1)	174.3 (37.9)	14.1 (26.3)	-10.0 (-27.0, 7.0)
Q con 240° s <sup>-1</sup> (Nm)	99.4 (9.6)	-0.2 (10.7)	97.5 (8.9)	0.9 (10.6)	-1.2 (-9.15, 6.7)
H con 60° s <sup>-1</sup> (Nm)	85.8 (13.7)	-0.9 (8.6)	91.5 (9.8)	-2.1 (5.4)	1.2 (-4.2, 6.6)
H ecc 60° s <sup>-1</sup> (Nm)	104.5 (15.0)	-1.4 (8.6)	106.5 (11.7)	-4.1 (12.0)	2.7 (-4.9, 10.2)
H con 240° s <sup>-1</sup> (Nm)	75.7 (9.8)	1.1 (6.9)	76.9 (9.1)	-1.0 (9.0)	2.1 (-3.8, 7.9)
<i>Isometric leg strength</i>					
Q iso 30° (Nm)	99.6 (14.8)	1.9 (10.5)	100.0 (11.8)	0.2 (7.7)	1.6 (-5.3, 8.6)
Q iso 60° (Nm)	165.5 (26.9)	4.1 (16.1)	163.9 (19.2)	8.3 (16.8)	-4.2 (-16.3, 8.0)
Q iso 90° (Nm)	153.2 (22.3)	4.1 (16.7)	150.1 (21.6)	16.4 (18.6)	-12.3 (-25.3, 0.7)
H iso 30° (Nm)	88.1 (16.4)	3.8 (15.2)	97.0 (14.3)	-1.5 (12.9)	5.3 (-5.2, 15.8)
H iso 60° (Nm)	80.4 (14.2)	4.7 (11.8)	83.8 (15.2)	4.9 (12.6)	-0.2 (-9.2, 8.8)
H iso 90° (Nm)	69.6 (10.9)	-0.5 (11.8)	67.4 (16.2)	0.6 (10.1)	-1.1 (-9.3, 7.0)
<i>Isometric adductor and abductor strength</i>					
Kicking foot extended (kg)	15.5 (2.1)	0.6 (1.7)	16.4 (2.2)	0.9 (2.2)	-0.2 (-1.6, 1.2)
Kicking foot flexed (kg)	16.8 (3.1)	0.4 (3.1)	15.4 (2.1)	2.1 (2.9)	-1.7 (-4.0, 0.5)
Stand foot (kg)	12.8 (1.6)	-1.8 (2.4)	13.9 (1.6)	-2.0 (1.8)	0.2 (-1.4, 1.8)
<i>Jumping ability</i>					
CMJ (cm)	27.9 (3.2)	-0.7 (1.4)	27.9 (2.4)	-1.3 (1.1)	0.6 (-0.4, 1.6)
VDJ (cm)	31.8 (3.9)	-0.3 (1.9)	32.3 (3.4)	-0.7 (2.1)	0.4 (-1.2, 1.9)
15-s RJ (cm)	23.3 (3.6)	-0.8 (2.0)	22.9 (3.4)	-0.5 (2.6)	-0.4 (-2.2, 1.5)
<i>Single sprint</i>					
40 m (s)	5.97 (0.25)	-0.04 (0.11)	5.93 (0.26)	0.01 (0.11)	0.03 (-0.06, 0.11)
<i>Football tests</i>					
Shuttle run with a ball (s)	9.79 (0.85)	-0.68 (0.81)	9.98 (0.82)	-0.71 (0.69)	0.03 (-0.53, 0.59)
Long distance kick (m)	35.1 (4.8)	-1.1 (3.4)	36.2 (5.6)	-0.9 (2.3)	-0.2 (-2.4, 2.0)

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