A 16-DAY RUNNING INTERVENTION DID NOT INFLUENCE BIOMECHANICAL RUNNING VARIABLES

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INTRODUCTION

The influence of fatigue on biomechanical running parameters has been investigated using different study designs: before and after a single running intervention [2,5] and continuously during running [1,3,6]. The findings of these studies are controversial. While fatigue was reported to alter ground reaction forces [1,3] impact shock [3] and rearfoot motion [3,5] other studies showed no alteration of these variables [2,6]. In epidemiological studies a rapid increase in running mileage is considered to be an important factor in the development of running injuries [4]. However, no study was found that investigated the effects of fatigue of an extreme increase in running mileage on biomechanical running parameters.

In August 2008 a 16-day relay race around Germany (www.lauf-kultour.de) with a total distance of 4000 km took place. This event was used as basis for our intervention study to investigate biomechanical running variables before and after the relay run.

METHODS

Eleven healthy subjects (10 ♂, 1 ♀) participated in this study (age: 23.3 ± 2.6 years, height: 178.0 ± 7.4 cm, weight: 74.5 ± 7.7 kg). During the 16-day intervention each runner performed 32 runs (mean distance: 10.4 km) with a rest period of 12 hours between runs. This resulted in a total of 303.3 ± 46.9 km per runner.

The experimental laboratory design included two measurements (PRE, POS-1) one day before and after the relay run and a second post measurement (POS-2) one week thereafter. For data collection (1 kHz) each runner performed five valid running trials at 3.5 ± 0.1 m/s in the same running shoe model. Ground reaction force was measured by a force plate (Kistler 9287BA). Peak tibial acceleration was analyzed by a lightweight accelerometer (Analog Devices ADXL78 ± 35g) and rearfoot motion was measured by an electrogoniometer (Megatron MP10 1kΩ).

Paired t-tests were used to analyze between group effects for PRE-1 and POS-1 and for POS-1 and POS-2 ($p<0.05$). Furthermore, the influence of individual running experience was analyzed by a multivariate analysis of variance (MANOVA).

RESULTS AND DISCUSSION

The magnitude of the analyzed kinetic and kinematic variables is similar to other studies [3,6]. The running intervention did not alter any of the observed biomechanical parameters significantly (Table 1). This was unexpected as subjects ran an average of 150 km per week during the relay race, which is approximately 2-3 times of their normal weekly mileage. Furthermore, these results were independent from individual running experience.

An explanation for these unexpected findings might be that the intensity of each single run was lower than those reported in other studies [3].

POS-2 showed that there also was no delayed effect of the intervention on biomechanical parameters as no group differences were found between POS-1 and POS-2.

Table 1: Mean, standard deviation, and p-value of 10 selected parameters: ground contact time (GCT), peak vertical force 1 and corresponding time (PVF1, TPVF1), maximum force rising rate (FRR), peak vertical force 2 (PVF2), peak tibial acceleration (PTA), maximum supination angle (MSA), maximum pronation angle (MPA), range of motion (ROM) and maximum pronation velocity (MPV).

Biom. Running Parameter	PRE-1		POS-1		T-Test
	Mean	S.D.	Mean	S.D.	p
GCT [s]	0.248	0.021	0.247	0.022	0.828
PVF1 [BW]	1.96	0.33	2.00	0.30	0.671
TPVF1 [s]	0.035	0.004	0.035	0.006	0.944
FRR [BW/s]	105.9	34.6	108.3	33.4	0.730
PVF2 [BW]	2.58	0.23	2.52	0.18	0.165
PTA [g]	9.4	2.7	9.6	3.6	0.750
MSA [°]	-5.8	3.5	-6.6	3.3	0.141
MPA [°]	7.3	3.0	6.5	2.6	0.151
ROM [°]	13.1	3.4	13.1	3.8	0.924
MPV [°/s]	417	112	409	113	0.695

CONCLUSIONS

This study shows that a 16-day running intervention did not influence biomechanical running variables neither directly after the intervention nor after one week of recovery. These findings lead to the assumption that the general gait pattern of individual running style is not influenced by high mileage running.

Therefore, in similar study designs including repeated measures less consideration needs to be paid on controlling running mileage between consecutive measurements.

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