THE STUDY OF MUSCLE FATIGUE EFFECT ON DYNAMIC STABILITY IN KNEE JOINT

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INTRODUCTION

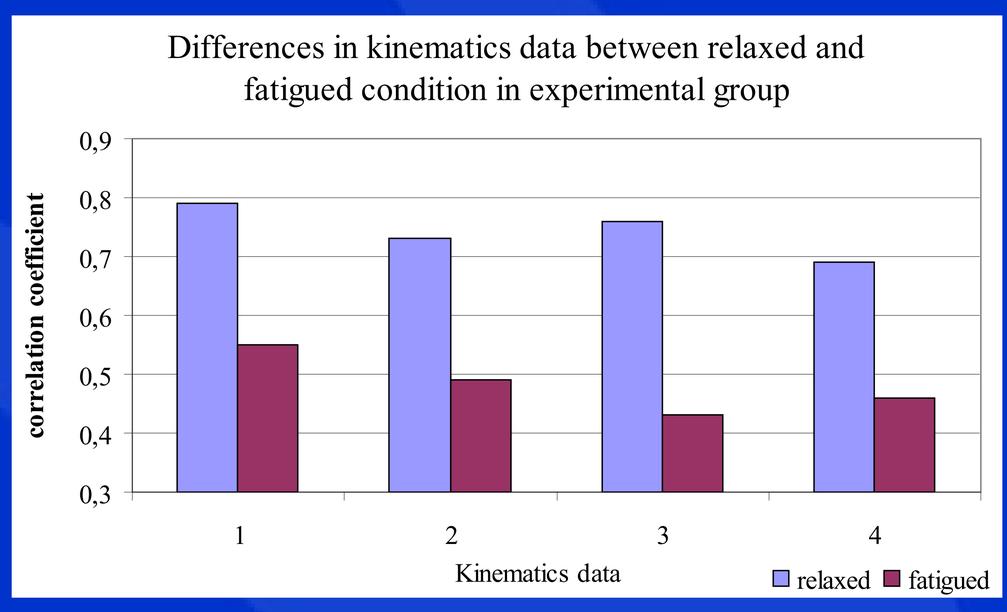
Over the past decade, there has been an increase in sports related injuries, particularly to the lower limbs. Injuries of the knee have been the commonest, and have the greatest potential to cause both short term and long term disability. The purpose of this research was to determine the effect of the lower extremity muscle fatigue on the proprioceptive sensitivity of the motor control in knee joint.

METHODS

Controlled motor tests of the landing as well as functional strain at the treadmill were applied. The test subject consisted of a control (n=10) and an experimental group (n=10). The test protocol for the experimental group consisted of following testing phases: 1. testing of the knee joint muscle power (execution of the maximum voluntary contraction, during which the myoelectric signals before fatigue were collected), 2. testing of the knee joint dynamic stability (execution of the tests with two-legged and one-legged (landings) from the 40 cm high bench, during which the kinematic and kinetic parameters were collected), 3. functional fatiguing of the lower extremity musculature (running at the treadmill with progressive strain until fail), 4. identical to phase 1, 5. identical to phase 2. The control group, contrary to the above stated, has maintained in the 3rd phase the daily level of the physical activity without fatiguing the musculature.
Following kinematic variables were studied: valgus and varus angle, angle of the inner and outer rotation as well as the angle of the flexion and extension in the knee joint and ground reaction force (GRF).
The original EMG signals m. vastus medialis, m. vastus lateralis, m. biceps femoris and m. gastrocnemius, have been measured during execution of the maximum static contraction lasting for 10 seconds and used for assessment of the fatigue by spectral analysis.

RESULTS AND DISCUSSION

The drop in media frequency of the EMG signal power spectrum was noticed at majority of the measured muscles, but statistically significant difference ($p<0.05$) between first and second measurement within the experimental group, only showed the muscles valstus medialis and vastus lateralis. The differences in the lactate concentration confirm these results and point to registered fatigue within the experimental group.
Correlational analysis of the measured signals gave an insight of the motor control and reproducibility of the landing stereotype [1]. Statistically significant drop in correlation coefficient of the kinematic parameters, within the experimental group after fatiguing, is particularly expressed in inner and outer rotation angle (3-right, 4-left) as well as valgus-varus movement (1-right, 2-left) of both legs, what points at a motor deficit i.e. decrease of the proprioceptive senses caused by musculature fatigue.
The analysis of the GRF signal shows statistically significant differences between groups at almost all components (1-right and 2-left mediolateral, 3-right and 4-left vertical) excluding component in direction front-back. This phenomenon could be explained with the way of landing execution, which does not require excessive efforts in the control of the forces in direction front-back [2].



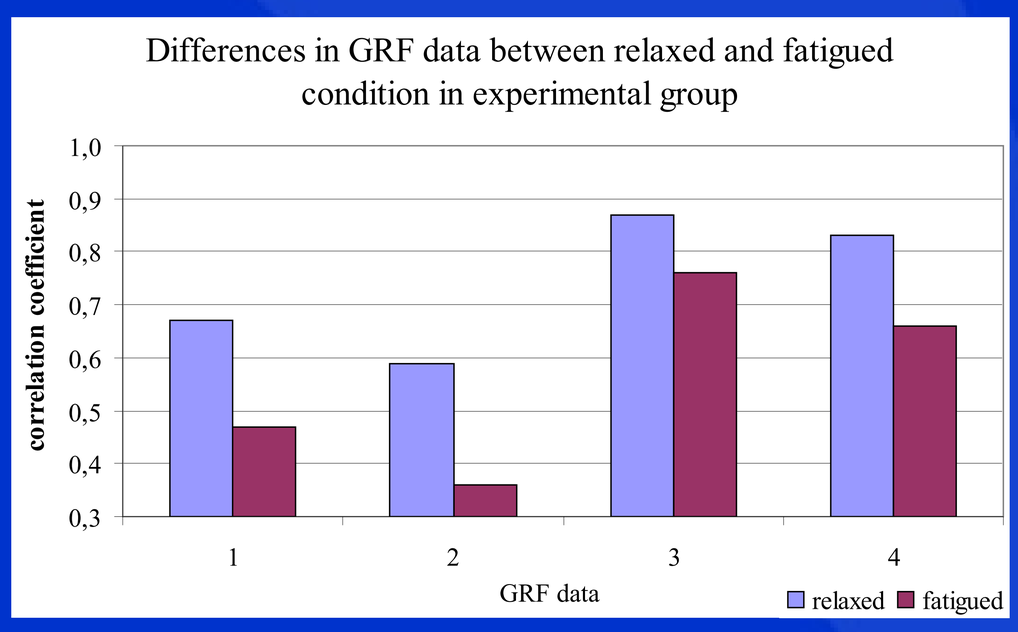


Figure 1 and 2: Differences in experimental group

CONCLUSIONS

This research showed a significant influence of the fatigue on the proprioceptive sensitivity and the motor control in knee joint. The implementation and benefit of this method could be in the prevention of the injuries in the rehabilitation phase, when the information of the athlete's ability for the increased strain is needed, and determining the proper moment for involvement into the training process or adequate kinesiological exercise programs respectively.

ACKNOWLEDGEMENT
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