

## ABSTRACT

### **Name of the thesis:**

Biomechanical aspects of speed canoeing techniques in the context of asymmetric loading of the postural system

### **Aim of the thesis:**

The main aim of the work was, based on theoretical knowledge and own empirical research, to analyze the biomechanical aspects of the technique of riding a C1 speed canoe in the context of asymmetric loading of the postural system .

### **Solution method:**

Based on the knowledge of functional anatomy and with the use of analyzes of the real riding of the top athletes (N = 12), the kinesiological aspects of riding the C1 speed canoe were investigated in the preliminary research. Biomechanical aspects of paddling were further investigated using 3D kinematic analysis (N = 9). Influence of long-term training efforts on differences in muscle cross-sections mm. iliopsoas a mm. quadratus lumborum on both sides of the body was examined by magnetic resonance imaging (N = 5). The muscle sections were performed in the transverse plane at the level of L 3, L 4. The studies were conceived as pilot due to their time, organizational and financial demands.

### **Results:**

Riding a C1 speed canoe is a locomotively complex movement pattern during which the postural system is exposed to two types of asymmetric loads. Both are related to the geometry of motion. First of all, it is a lateral asymmetry, which is based on the very essence of one-sided paddling on this type of canoe. The second asymmetry is associated with the anteroposterior movement of the torso and its time-dependent deviation from the neutral position. While the knee of the kneeling lower limb and the foot of the supporting lower limb are fixed to the boat, the hull together with the head and upper limbs perform movements in a relatively wide range. Thus, there

is a significant disproportion between the fixation movements of the lower half and the phasic movements of the upper half of the body.

When riding a C1 speed canoe there is unilateral overloading of the quadratus lumborum on the side of the supporting lower limb (side without paddle), overloading of the lumbar spine straighteners, especially on the side of the supporting lower limb, and bilateral overloading of the iliopsoas, which also takes place in other isometries. The very asymmetrical position of the lower limbs and holding the paddle on one side of the boat creates instability, which the canoeist must compensate by shifting the center of gravity of the body more above the kneeling lower limb. This is achieved by the so-called lateralization of the pelvis from the side of the paddling and its inclination to the kneeling lower limb. The compensation is intensified in the engagement phase, when the inclination of the pelvis, its deflection and inclination are most prominent.

Furthermore, it can be assumed that in the longitudinal training effort, the lateral disproportion in the volume and intensity of the load on the postural system is the cause of different cross sections of the iliopsoas and quadratus lumborum on the side of the kneeling and supporting lower limb. For both muscles, larger cross-sections can be expected ( $\alpha= 0.05$ ) and thus also the strength on the side of the supporting lower limb.

As part of the solution of the research problem, an anthropomorphic mechanism was designed, which together with the created SW application allows to monitor changes in the kinematic geometry of locomotor movement patterns, not only in sports, but also in physiotherapy and rehabilitation.

**Key words:**

Speed canoeing; asymmetric load; postural system; biomechanical aspects of paddling.