

## Summary

**Title:** Influence of Hyperkinetic Load on Selected Mechanical Changes of Human Axial System.

**Objectives:** The main aim of this thesis is to determine the influence of hyperkinetic load on the change of selected mechanical properties of the rhythmic gymnastic axial system based on the sophisticated use of the Transfer Vibration through Spine (TVS) method.

**Methods:** The following experimental methods were used to identify changes in rheological properties of AS and to assess load intensity:

- 1) TVS method;
- 2) software for evaluating and analyzing vibration tests of heterogeneous systems;
- 3) kinematic and dynamic motion analysis using:
  - 2D motion video recording,
  - QUALISYS 3D motion analysis system,
  - KISTLER, to analyze dynamic human-surroundings interactions.

**Results:** Pilot studies and the main experimental part of the thesis have shown that the use of the TVS method can identify both short-term and longitudinal changes of AS mechanical properties. Due to the hyperkinetic load, the selected mechanical properties of the rhythmic AS are changed. The gymnastic apparatus reacts to the training load by reducing the rheological parameters, especially the damping coefficient  $b$  and the viscosity  $\mu$ . After regeneration, which is on the following day, the parameters return to the default values.

The impact load in the total sum of performed jumps during the year-long training process of rhythmic gymnasts represents 2–5 times the load on the human musculoskeletal system and its AS compared to the civilian regime – with up to 19,000 repetitions per year.

**Key Words:** rheology, TVS method, impact load, viscosity, damping, elasticity.