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# Can exercise improve the outcome in non-small cell lung cancer patients upon immunotherapy? Introducing a Study Protocol.

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Introduction. Lung cancer is the number one cause of cancer-related fatalities worldwide, with 80% of cases classified as non-small cell lung cancer (NSCLC). Novel immunotherapies have markedly improved the outcome in certain subsets of patients. Exercise has a known immune-stimulating effect with various interleukins being significantly elevated in response to exercise.
Methods. In our 3-arm study, we plan two groups with a 12-weeks exercise program at clearly defined intensities and durations, tailored for each patient's fitness level and metabolic thresholds according to spiroergometry. The intervention consists of 2 supervised training sessions per week, together with home-based low-intensity continuous walking exercise. Training groups will perform either moderate-intensity continuous exercise or matched high-intensity interval exercise including metabolic priming. Within 2 years, 90 patients with NSCLC upon immunotherapy will be enrolled at first diagnosis. Outcome parameters will be treatment response according to RECIST criteria, as compared to control patients not participating in the intervention (receiving physical activity recommendations), as well as cytokine analysis from venous blood sampling, mitochondrial function analysis via Seahorse, mass spectrometry focusing on lipidomics and an in-depth evaluation of immune cell metabolism via FACS analysis. A follow-up visit at 6 months post enrolment is scheduled.
Outlook. Project start is scheduled for January 2026, and preliminary results will be presented at the conference.

## Keywords

Non-small cell lung cancer; exercise; training; immunotherapy; high-intensity interval training

## Conflict of Interest & Ethical Approval

yes

## Abstract submitters declaration

yes

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