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Tai Chi and IPC in adults with and without type 2 diabetes

Submission date	Recruitment status	[X] Prospectively registered
14/02/2026	No longer recruiting	[X] Protocol
Registration date	**Overall study status**	[_] Statistical analysis plan
16/02/2026	Ongoing	[_] Results
Last Edited	**Condition category**	[_] Individual participant data
22/10/2026	Nutritional, Metabolic, Endocrine	[X] Record updated in last year

Plain English summary of protocol

Background and study aims

This study examines the effects of Tai Chi, a gentle form of exercise, in adults aged 50 years or older with or without type 2 diabetes. The project includes metabolic and vascular components and a component focused on physical function and quality of life.

The metabolic and vascular component examines whether ischemic preconditioning provides additional benefits when combined with Tai Chi in participants with type 2 diabetes. This technique uses inflatable cuffs to temporarily restrict blood flow to the legs, followed by periods in which blood flow is restored. The main outcome in this component is long-term blood sugar control, measured using glycated haemoglobin (HbA1c). Blood vessel function, including blood flow through small vessels, is also assessed.

The physical function and quality-of-life component compares a Tai Chi-based exercise programme with a control group maintaining their usual lifestyle and activity. This component includes participants with or without diabetes. Neither active nor sham ischemic preconditioning is used in these two groups. Assessments include quality of life, functional fitness using the Senior Fitness Test, standing balance and thigh muscle stiffness. Additional measurements include body weight, body mass index, waist circumference, body fat and muscle mass percentages, and blood pressure. Satisfaction with the programme is assessed in the Tai Chi group after the intervention.

The assessments and interventions are specific to each component of the project.

Who can participate?

The overall project includes adults aged 50 years or older, with or without type 2 diabetes, according to the eligibility requirements of the relevant study component. There is no fixed upper age limit for the overall project, provided that the person’s health allows safe participation.

Participants must be able to walk independently, understand the study information, provide informed consent and safely undertake low- to moderate-intensity exercise following assessment by a doctor or physiotherapist. They must also meet the relevant requirements concerning previous physical activity and health status.

For the metabolic and vascular component requiring type 2 diabetes, participants must have had a confirmed diagnosis for at least six months and must have been on stable diabetes medication for at least three months before enrolment, with no planned changes during the 12-week intervention.

Diabetes is not a requirement for the physical function and quality-of-life component. This component includes people with and without diabetes. Additional safety criteria apply to participants undergoing cuff procedures.

What does the study involve?
Participants are randomly assigned to groups within the relevant component of the project.

The metabolic and vascular component includes usual care, Tai Chi alone, Tai Chi combined with ischemic preconditioning, and Tai Chi combined with a sham cuff procedure. The sham procedure uses low cuff pressure as a comparison with active ischemic preconditioning. The registered Tai Chi schedule for this component consists of three supervised 45-minute sessions each week for 12 weeks, including a warm-up, adapted Tai Chi movements and a cool-down. In the active ischemic preconditioning group, a min 30-minute max 45 min cuff procedure takes place before Tai Chi.

The physical function and quality-of-life component includes a Tai Chi-based programme and a control group maintaining their usual lifestyle and activity without starting a new organised exercise programme. The Tai Chi programme consists of three supervised sessions each week for 12 weeks. Although sessions were initially planned to last 45 minutes, the sessions delivered in this component lasted approximately 60 minutes because participants needed additional time to learn and practise the movements.

The programme includes warm-up and mobility exercises, modified Yang-style Tai Chi, balance and weight-shifting exercises, coordination, breathing exercises and a cool-down. Additional activities include body awareness, gentle muscle and fascial relaxation, individual and paired exercises, and education about physical activity and healthy ageing. Participants are also advised to complete three approximately 15-minute home practice sessions each week on days without supervised classes.

Assessments take place before the intervention, after min 8- max 12 weeks and four weeks after the supervised programme ends. Laboratory and blood vessel assessments are performed in the relevant metabolic and vascular groups. Physical function and quality-of-life assessments are performed in the corresponding functional groups. Not every participant undergoes every measurement.

What are the possible benefits and risks of participating?
Participants may experience improvements in physical fitness, balance or quality of life. Participants with type 2 diabetes may also experience improvements in blood sugar control. These benefits cannot be guaranteed.

Exercise may cause temporary tiredness, muscle soreness or loss of balance. SessionsStaff adapt sessions to participants' abilities and supervise themce these risks. Cuff procedures may cause

temporary pressure or discomfort in the legs. Blood sampling, where required, may cause brief discomfort or bruising. Participants are assessed for suitability before taking part, and the interventions are supervised by trained staff.

Where is the study run from?
The study is coordinated by Centrum Medyczne Provita in Żory, Poland. The project also involves the Inżbud Octagon Sports Club in Żory.

When is the study starting and how long is it expected to run for?
Recruitment was scheduled to begin in March 2026. Each participant's intervention lasts 12 weeks, followed by a further assessment four weeks later. The overall project is scheduled to finish in November 2026.

Who is funding the study?
Centrum Medyczne Provita, Poland, is funding the study

Who is the main contact?
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Contact information

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Study information

Scientific Title
Effects of Tai Chi, alone or combined with ischemic preconditioning, on metabolic parameters, vascular function, functional fitness and quality of life in adults aged 50 years and older with or without type 2 diabetes

Acronym
Tai Chi - Dt2

Study objectives
Current study objectives as of 22/10/2026:

Primary objective:
To determine whether ischemic preconditioning (IPC) applied before Tai Chi exercise provides additional benefits for glycemic control, measured by glycated hemoglobin (HbA1c), in adults aged 50 years or older with type 2 diabetes mellitus, compared with Tai Chi alone, Tai Chi combined with sham IPC, or usual care.

Secondary and exploratory objectives:
1. To assess the effects of the interventions on microvascular function using the post-occlusive reactive hyperemia (PORH) test with laser Doppler flowmetry in the metabolic and vascular component of the study
2. To evaluate the effects of a Tai Chi-based multicomponent exercise programme on functional fitness and quality of life in adults aged 50 years or older with or without type 2 diabetes. This component compares the exercise programme with a control group maintaining their usual lifestyle and activity, without active or sham IPC. Functional fitness is assessed using the Senior Fitness Test. Analyses of functional fitness and the recorded quality-of-life measures are exploratory
3. To assess changes in postural control using centre-of-pressure measurements with eyes open and closed, and in rectus femoris muscle stiffness using shear-wave elastography, in the physical function and quality-of-life component
4. To evaluate changes in body mass, body mass index, waist circumference and blood pressure, together with body fat and muscle mass percentages where measured in the relevant study component
5. To assess exercise intensity, adherence and safety, including adverse events, according to the procedures applicable to each study component, and to evaluate participant satisfaction after completion of the Tai Chi-based multicomponent programme
6. To assess whether the effects observed after the min 8- max12-week intervention are maintained four weeks after completion, using the follow-up measurements applicable to each study component

Overall study aim:
The study aims to evaluate the effects of Tai Chi, alone or combined with IPC, across complementary components of a broader research project involving adults aged 50 years or older with or without type 2 diabetes. The metabolic and vascular component focuses on glycemic control and microvascular function in participants with type 2 diabetes. The physical function and quality-of-life component includes participants with and without diabetes and examines functional fitness, postural control, muscle stiffness and quality of life. Eligibility requirements, interventions and outcome measurements are specified separately for each component.

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Previous study objectives:

Primary objective:
To determine whether ischemic preconditioning (IPC) applied prior to Tai Chi exercise leads to a greater improvement in glycemic control, as measured by glycated hemoglobin (HbA1c), in individuals aged ≥50 years with type 2 diabetes mellitus, compared to Tai Chi alone, sham IPC, or usual care

Secondary objectives:
1. To assess the effects of the intervention on microvascular function using the post-occlusive reactive hyperemia (PORH) test with laser Doppler flowmetry
2. To evaluate changes in anthropometric parameters, including body mass, BMI, and waist circumference
3. To assess exercise intensity, adherence to the training program, and safety outcomes, including adverse events
4. To determine whether the observed effects persist at a 4-week follow-up after completion of the intervention

The study aims to provide high-quality clinical evidence regarding the potential of combining a safe, low-intensity exercise modality (Tai Chi) with a non-invasive physiological intervention (IPC) to enhance metabolic and vascular outcomes in older adults with type 2 diabetes

Ethics approval required
Ethics approval required

Ethics approval(s)
Approved 04/01/2026, Research Ethics Committee of Physiotherapists at the Polish Physiotherapy Association (Correspondence Address: Centrum Rehabilitacji Funkcjonalnej ORTHOS ul. Z. Modzelewskiego 37, unit U8, Warsaw, 02-679, Poland; + 48 601 300 080; Email: biuro@fizjoterapeuci.org), ref: No. 4/01/2026

Primary study design
Interventional

Allocation
Randomized controlled trial

Masking
Blinded (masking used)

Control
Placebo

Assignment
Parallel

Purpose
Prevention, Treatment

Study type(s)

Health condition(s) or problem(s) studied
Adults ≥50 years with and without type 2 diabetes

Interventions
Current interventions as of 22/10/2026:

The intervention comprises a 12-week supervised Tai Chi exercise programme, delivered alone or in combination with ischemic preconditioning (IPC), depending on group allocation

Tai Chi programme in the metabolic and vascular component:
Participants assigned to the Tai Chi groups attend supervised group sessions three times per week for 12 consecutive weeks. Each session lasts 45 minutes and is conducted by a qualified physiotherapist or certified Tai Chi instructor under controlled conditions.

Each session includes 10 minutes of warm-up and mobility exercises, 30 minutes of modified Yang-style Tai Chi, and 5 minutes of cool-down and breathing exercises. A simplified therapeutic form comprising 8–12 movements is adapted to the abilities of participants aged 50 years or older, avoiding deep stances and rapid rotations.

Exercise intensity is monitored using the Borg Rating of Perceived Exertion scale, ranging from 6 to 20, the talk test and heart rate monitoring in a subgroup of participants.

Ischemic preconditioning:
In the Tai Chi combined with active IPC group, a 30-minute IPC procedure is performed immediately before each exercise session.

IPC is administered using the Delfi Personalized Tourniquet System. Occlusion cuffs measuring 12 cm in width are positioned proximally on both lower limbs. Individual arterial occlusion pressure (AOP) is determined before the intervention, and the working pressure is set at 100% of the individually determined AOP.

The procedure comprises three cycles of 5 minutes of arterial occlusion followed by 5 minutes of reperfusion, giving a total duration of 30 minutes. Participants remain seated or supine, and their well-being is monitored throughout the procedure.

Sham ischemic preconditioning:
In the Tai Chi combined with sham IPC group, a procedure with the same duration and cuff placement as active IPC is administered before each exercise session. Cuff pressure is set at 20 mmHg rather than at the pressure required to achieve arterial occlusion.

Usual care group:
Participants assigned to usual care maintain their habitual lifestyle and physical activity level without participating in the supervised Tai Chi programme.

Additional physical function and quality-of-life component:
This component compares a Tai Chi-based multicomponent exercise programme with a control group maintaining their usual lifestyle and physical activity. A diagnosis of type 2 diabetes is not an eligibility requirement for this component, which includes participants with and without diabetes.

The intervention group comprises 30 participants undertaking a 12-week programme with three supervised sessions per week, each lasting approximately 60 minutes. The programme includes warm-up and mobility exercises, modified Yang-style Tai Chi, balance and weight-shifting exercises, movement coordination, breathing exercises and a cool-down.

Additional elements include body awareness exercises, gentle myofascial relaxation techniques, individual and paired exercises, and education about physical activity and healthy ageing. Participants are also advised to complete three approximately 15-minute home practice sessions per week on days without supervised sessions.

The control group comprises 30 participants maintaining their habitual lifestyle and physical activity without participating in an organised exercise programme. Participants are instructed not to begin a new organised training programme or make major dietary changes during the study.

Neither active nor sham IPC is administered in either group of this component. Assessments are conducted before the intervention, after 12 weeks and four weeks after completion of the supervised programme.

Assessments include functional fitness measured using the six Senior Fitness Test tasks, quality of life, postural control assessed through centre-of-pressure parameters under eyes-open and eyes-closed conditions, and right and left rectus femoris stiffness assessed using shear-wave elastography. Additional measurements include body mass, body mass index, waist circumference, body fat and muscle mass percentages, and blood pressure. Participant satisfaction is assessed in the intervention group after completion of the programme.

Analyses of this component are exploratory. The recorded aggregate quality-of-life score is not interpreted as a validated WHOQOL-BREF domain score. Biochemical and microvascular assessments are assigned to the metabolic and vascular component and are not included in the measurement schedule of this functional component.

Attendance:
The minimum attendance threshold for inclusion in the analysis is 70% of scheduled supervised sessions. For a programme comprising 36 scheduled sessions, this corresponds to attendance at a minimum of 26 sessions. Participants with attendance of 70% or higher meet this criterion.

Randomisation and allocation concealment:
Participants are allocated to study groups using a computer-generated randomisation sequence prepared through an online randomisation tool.

Allocation is implemented using sealed, opaque, sequentially numbered envelopes prepared by an independent member of the research team who is not involved in participant recruitment or

outcome assessment. This procedure provides allocation concealment and reduces the risk of selection bias.

In the physical function and quality-of-life component, the allocation ratio is 1:1 between the Tai Chi programme and control groups, with 30 participants in each group.

Safety:
The interventions are non-invasive. Supervised exercise sessions and cuff procedures are conducted according to the safety procedures applicable to each study component. Exercises are adapted to participants' abilities. Participants undergoing active or sham IPC must additionally meet the safety criteria applicable to cuff procedures.

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Previous interventions:

The intervention consists of a 12-week supervised exercise program with or without ischemic preconditioning (IPC), depending on group allocation

Tai Chi Program
Participants assigned to the Tai Chi groups will attend supervised group sessions three times per week for 12 consecutive weeks. Each session will last 45 minutes and will be conducted by a qualified physiotherapist or certified Tai Chi instructor under controlled conditions

Each session will include:
10 minutes of warm-up and mobility exercises,
30 minutes of modified Yang-style Tai Chi (therapeutic simplified form, 8–12 movements adapted for individuals aged ≥50 years, avoiding deep stances and rapid rotations),
5 minutes of cool-down and breathing exercises
Exercise intensity will be monitored using the Borg Rating of Perceived Exertion (6–20 scale), the talk test, and heart rate monitoring in a subgroup of participants

Ischemic Preconditioning (IPC)
In the IPC Tai Chi group, a 30-minute IPC session will be performed immediately before each Tai Chi session
IPC will be administered using a pneumatic tourniquet system (Delfi Personalized Tourniquet System). Occlusion cuffs (12 cm width) will be placed proximally on both lower limbs. Individual arterial occlusion pressure (AOP) will be determined for each participant prior to the intervention. The working IPC pressure will be set at 100% of the individually determined AOP
The IPC protocol will follow a standard ischemia–reperfusion sequence:
5 minutes of arterial occlusion,
5 minutes of reperfusion,
repeated three times (total duration: 30 minutes)

Participants will remain seated or supine during the procedure, and their well-being will be continuously monitored.

Sham IPC
In the SHAM Tai Chi group, a sham procedure will be applied before each Tai Chi session. The procedure will be identical in duration and setup; however, cuff pressure will be set at 20 mmHg, which does not induce arterial occlusion or physiological IPC effects

Usual Care Group
Participants assigned to the usual care group will maintain their habitual lifestyle and physical activity level without participation in the supervised Tai Chi program

All interventions are non-invasive, supervised, and conducted under standardized safety procedures.

Participants will be randomly allocated to study groups using a computer-generated randomisation sequence. The allocation sequence will be generated using an online randomisation tool to ensure true randomness.
Group assignments will be implemented using sealed, opaque, sequentially numbered envelopes prepared in advance by an independent member of the research team who is not involved in participant recruitment or outcome assessment. This procedure ensures allocation concealment and minimises selection bias.
Randomisation will follow a 1:1 allocation ratio between the intervention and control groups.

Intervention Type
Procedure/Surgery

Primary outcome(s)
1. Glycated hemoglobin (HbA1c, %) measured using certified laboratory high-performance liquid chromatography (HPLC) method at baseline (T0) and after 12 weeks (T2)

2. Microvascular peak hyperemic response (PORH peak value) measured using laser Doppler flowmetry (PeriFlux System, Perimed) during the Post-Occlusive Reactive Hyperemia (PORH) test at baseline (T0), after 12 weeks (T2), and 4-week follow-up (T3)
3. Resting microcirculatory flow (REST FLOW) measured using laser Doppler flowmetry (PeriFlux System, Perimed) during the PORH test at baseline (T0), after 12 weeks (T2), and 4-week follow-up (T3)
4. Time to peak hyperemic response (PORH parameter) measured using laser Doppler flowmetry (PeriFlux System, Perimed) at baseline (T0), after 12 weeks (T2), and 4-week follow-up (T3)
5. Recovery time of microcirculatory flow (PORH parameter) measured using laser Doppler flowmetry (PeriFlux System, Perimed) at baseline (T0), after 12 weeks (T2), and 4-week follow-up (T3) measured using Primary Outcome Glycated hemoglobin (HbA1c, %) measured using a certified laboratory high-performance liquid chromatography (HPLC) assay, expressed as percentage (%), assessed at baseline (T0) and after 12 weeks of intervention (T2)

Exploratory outcomes (added 22/10/2026):
1. 30-second chair stand performance (number of repetitions) measured using the Senior Fitness Test 30-second chair stand test at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
2. 30-second arm curl performance (number of repetitions) measured using the Senior Fitness Test 30-second arm curl test at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
3. 2-minute step test performance (step count) measured using the Senior Fitness Test 2-minute step test at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
4. Chair sit-and-reach distance (cm) measured using the Senior Fitness Test chair sit-and-reach test at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
5. Back scratch distance (cm) measured using the Senior Fitness Test back scratch test at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
6. 8-foot up-and-go time (seconds) measured using the Senior Fitness Test 8-foot up-and-go test

at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
7. Quality of life aggregate score (26-130 points) measured using the WHOQOL questionnaire aggregate score at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
8. Overall quality of life (1-5 points) measured using the WHOQOL questionnaire general item on overall quality of life at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
9. Satisfaction with health (1-5 points) measured using the WHOQOL questionnaire general item on satisfaction with health at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
10. Centre-of-pressure sway area (mm^2) under eyes-open conditions measured using centre-of-pressure assessment at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
11. Centre-of-pressure sway area (mm^2) under eyes-closed conditions measured using centre-of-pressure assessment at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
12. Centre-of-pressure path length (mm) under eyes-open conditions measured using centre-of-pressure assessment at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
13. Centre-of-pressure path length (mm) under eyes-closed conditions measured using centre-of-pressure assessment at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
14. Right rectus femoris muscle stiffness (kPa) measured using shear-wave elastography at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme
15. Left rectus femoris muscle stiffness (kPa) measured using shear-wave elastography at baseline, after 12 weeks, and 4 weeks after completion of the supervised programme

Key secondary outcome(s)

1. Glycated hemoglobin (HbA1c, %) measured using a certified laboratory highperformance liquid chromatography (HPLC) assay at baseline (T0) and after 12 weeks (T2)

2. Peak hyperemic response (perfusion units) measured using laser Doppler flowmetry during the PostOcclusive Reactive Hyperemia (PORH) test at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

3. Resting microvascular blood flow (perfusion units) measured using laser Doppler flowmetry during the PORH protocol at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

4. Time to peak hyperemic response (seconds) measured using laser Doppler flowmetry during the PORH test at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

5. Microvascular recovery time (seconds) measured using laser Doppler flowmetry during the PORH test at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

6. Resting systolic and diastolic blood pressure (mmHg) measured using an automated validated sphygmomanometer at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

7. Body mass (kg) measured using a calibrated digital scale at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

8. Body mass index (kg/m^2) measured using calculated values from measured height and body mass at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

9. Waist circumference (cm) measured using standard anthropometric tape at baseline (T0), after 12 weeks (T2), and at 4week followup (T3)

10. Perceived exercise intensity (Borg RPE 6–20 score) measured using the Borg Rating of Perceived Exertion scale at after each training session during the 12week intervention period

11. Heart rate (beats per minute) measured using wristworn smartwatch heart rate monitors at during selected training sessions throughout the 12week intervention period

12. Adherence rate (%) measured using attendance records at the end of the 12week intervention period (T2)

13. Adverse events (number and type) measured using standardized adverse event documentation forms at baseline (T0) through postintervention (T2) and followup (T3)

Completion date
30/11/2026

Eligibility

Key inclusion criteria
Current key inclusion criteria as of 22/10/2026:

1. Adults aged 50 years or older, with no fixed upper age limit, with or without a diagnosis of type 2 diabetes, provided that their health permits safe participation; a diagnosis of diabetes is not required for the component assessing functional fitness and quality of life
2. Diagnosed with type 2 diabetes mellitus (T2DM) according to current diagnostic criteria
3. Duration of diabetes of at least 6 months
4. No changes in antidiabetic treatment (type of medication or dosage) for at least 3 months prior to study enrolment
5. No planned changes in pharmacological treatment during the 12-week intervention period
6. No regular exercise habits, defined as:
6.1. No structured training-type physical activity ≥1 session per week during the past 3–6 months
6.2. Occasional low-intensity recreational activity (e.g., walking) is permitted
7. Ability to ambulate independently
8. Ability to safely participate in low- to moderate-intensity exercise (Tai Chi) as assessed by a qualifying physician or physiotherapist
9. Signed informed consent to participate in the study
10. Consent to undergo laboratory testing and clinical measurements

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Previous key inclusion criteria:

1. Individuals aged ≥50 years (no upper age limit, provided that clinical status allows safe participation)
2. Diagnosed with type 2 diabetes mellitus (T2DM) according to current diagnostic criteria
3. Duration of diabetes of at least 6 months
4. No changes in antidiabetic treatment (type of medication or dosage) for at least 3 months prior to study enrolment

5. No planned changes in pharmacological treatment during the 12-week intervention period
6. No regular exercise habits, defined as:
6.1. No structured training-type physical activity ≥1 session per week during the past 3–6 months
6.2. Occasional low-intensity recreational activity (e.g., walking) is permitted
7. Ability to ambulate independently
8. Ability to safely participate in low- to moderate-intensity exercise (Tai Chi) as assessed by a qualifying physician or physiotherapist
9. Signed informed consent to participate in the study
10. Consent to undergo laboratory testing and clinical measurements

Healthy volunteers allowed
Yes

Age group
Mixed

Lower age limit
50 Years

Upper age limit
90 Years

Sex
All

Total final enrolment
120

Key exclusion criteria
Current key exclusion criteria as of 22/10/2026:

1. Cardiovascular and Systemic Contraindications
1.1. Unstable coronary artery disease
1.2. Myocardial infarction or stroke within <6 months prior to enrollment
1.3. Uncontrolled arterial hypertension (resting SBP ≥180 mmHg or DBP ≥110 mmHg)
1.4. Severe heart failure (New York Heart Association [NYHA] class III–IV)
2. Vascular and Neurological Conditions
2.1. Diagnosed advanced peripheral artery disease (PAD) with symptoms of critical limb ischemia
2.2. Active lower-limb ulcers, trophic changes, or infections
2.3. Severe diabetic neuropathy with significant impairment of pain or pressure sensation
2.4. Other neurological disorders that may interfere with the safe performance of exercise (e.g., advanced Parkinson’s disease)
3. Contraindications to Ischemic Preconditioning (IPC)
3.1. History of deep vein thrombosis (DVT) or pulmonary embolism
3.2. Known coagulation disorders
3.3. Significant lower-limb vascular disease preventing the safe use of occlusion cuffs (e.g., advanced atherosclerosis; ankle–brachial index [ABI] <0.75 or >1.10)
3.4. Intolerance to limb compression or significant pain during the preliminary IPC procedure test
4. Orthopedic and Functional Contraindications
4.1. Acute inflammation, injury, or exacerbation of musculoskeletal disorders
4.2. Significant mobility limitations or deformities preventing the performance of Tai Chi

exercises, even in a modified form.
4.3. Recent surgery (<6 months)
5. Other Exclusion Factors
5.1. Active malignancy under current treatment
5.2. Severe cognitive impairment or psychiatric disorders preventing informed participation
5.3. Participation in another clinical trial or interventional study within the past 3 months
5.4. Lack of informed consent or withdrawal of consent at any stage of the study

Adherence Criterion:
Participants are required to attend at least 70-75 % of the scheduled exercise sessions. Individuals whose attendance falls below 70%- 75 % of the total planned sessions during the minimum 8, maximum 12-week intervention will be excluded from the final analysis

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Previous key exclusion criteria:

1. Cardiovascular and Systemic Contraindications
1.1. Unstable coronary artery disease
1.2. Myocardial infarction or stroke within <6 months prior to enrollment
1.3. Uncontrolled arterial hypertension (resting SBP ≥180 mmHg or DBP ≥110 mmHg)
1.4. Severe heart failure (New York Heart Association [NYHA] class III–IV)
2. Vascular and Neurological Conditions
2.1. Diagnosed advanced peripheral artery disease (PAD) with symptoms of critical limb ischemia
2.2. Active lower-limb ulcers, trophic changes, or infections
2.3. Severe diabetic neuropathy with significant impairment of pain or pressure sensation
2.4. Other neurological disorders that may interfere with the safe performance of exercise (e.g., advanced Parkinson's disease)
3. Contraindications to Ischemic Preconditioning (IPC)
3.1. History of deep vein thrombosis (DVT) or pulmonary embolism
3.2. Known coagulation disorders
3.3. Significant lower-limb vascular disease preventing the safe use of occlusion cuffs (e.g., advanced atherosclerosis; ankle–brachial index [ABI] <0.75 or >1.10)
3.4. Intolerance to limb compression or significant pain during the preliminary IPC procedure test
4. Orthopedic and Functional Contraindications
4.1. Acute inflammation, injury, or exacerbation of musculoskeletal disorders
4.2. Significant mobility limitations or deformities preventing the performance of Tai Chi exercises, even in a modified form.
4.3. Recent surgery (<6 months)
5. Other Exclusion Factors
5.1. Active malignancy under current treatment
5.2. Severe cognitive impairment or psychiatric disorders preventing informed participation
5.3. Participation in another clinical trial or interventional study within the past 3 months
5.4. Lack of informed consent or withdrawal of consent at any stage of the study

Adherence Criterion:
Participants are required to attend at least 70% of the scheduled exercise sessions. Individuals whose attendance falls below 70% of the total planned sessions during the 12-week intervention will be excluded from the final analysis

Date of first enrolment
09/03/2026

Date of final enrolment
30/03/2026

Locations

Countries of recruitment
Poland

Study participating centre
Medical Center Provita
37 United Europe Avenue
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Study participating centre
Inżbud Octagon Sports Club
28 Szeroka Street
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Sponsor information

Organisation
Centrum Medyczne Provita

Organisation
Upper Silesian Academy in Katowice

Funder(s)

Funder type

Funder Name
Centrum Medyczne Provita

Results and Publications

Individual participant data (IPD) sharing plan

IPD sharing plan summary
Not expected to be made available

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	in Polish		16/02/2026	No	Yes
Protocol file			16/02/2026	No	No