ISRCTN66167429 https://doi.org/10.1186/ISRCTN66167429

The effects of trail versus road running on neuromuscular performance

Submission date	Recruitment status	[ ] Prospectively registered
29/11/2017	No longer recruiting	[ ] Protocol
Registration date	**Overall study status**	[ ] Statistical analysis plan
04/12/2017	Completed	[ ] Results
Last Edited	**Condition category**	[ ] Individual participant data
30/11/2017	Injury, Occupational Diseases, Poisoning	[ ] Record updated in last year

Plain English summary of protocol

Background and study aims
Previous research indicates that exercising on different surfaces with varying demands for the body and mind might beneficially affect neuromuscular performance and reduce fall risk factors in elderly, middle-aged, or young persons. To this end, the impact of running on unpredictable dirt trails vs. paved road has not yet been compared. It could be possible that trail running leads to stronger adaptations in fall prevention musculature. The aim of this study is to examine if trail running has beneficial improvements in muscle performance, therefore reducing injuries or falls.

Who can participate?
Healthy adults aged 18 to 59 who are currently living a sedentary lifestyle.

What does the study involve?
All participants join a running program for a period of 8 weeks, 3-5 times a week for around 25-45 minutes. Participants re randomly allocated to one of two groups. Those in the first group perform the running program on the outdoor trail. Those in the second group perform the running program on the road. Perceived exertion levels are recorded by each participant in an individually prepared training logbook along with other information, such as duration and mileage of the run, and how they felt after each workout. Pre- and posttraining program testing sessions are scheduled before and after the program to evaluate participants static and dynamic balance, gait analysis, agility, leg strength, and endurance capacity.

What are the possible benefits and risks of participating?
Participants may benefit from being encouraged to exercise more and having the confidence to hike, walk or run outside and maintain a healthy lifestyle. Participants also are given insights on their physical fitness and their balance, strength, gait and agility performance. Exercise can cause discomforts and risks such as fatigue, nausea, dizziness, lightheadedness, shortness of breath, muscle soreness, injuries such as pulled and torn muscles, heart arrhythmias and heart attacks. These risks are very unlikely at the exercise intensities applied in this study.

Where is the study run from?
Northern Michigan University (USA)

When is the study starting and how long is it expected to run for?
July 2016 to December 2016

Who is funding the study?
Investigator initiated and funded (Switzerland)

Who is the main contact?
Marisa Heckendorn (Scientific)
Marisa.Heckendorn@unibas.ch

Contact information

Type(s)
Public

Contact name
Ms Marisa Heckendorn

ORCID ID
https://orcid.org/0000-0001-6712-8808

Contact details
University of Basel
DSBG
Birsstrasse 320
Basel
Switzerland
4052

Type(s)
Scientific

Contact name
Prof Lars Donath

Contact details
German Sport University Cologne
Department of Intervention Research in Exercise Training
Am Sportpark Müngersdorf 6
Köln
Germany
50933

Type(s)
Scientific

Contact name
Prof Scott Drum

Contact details

Northern Michigan University
School of Health and Human Performance
Office 201F PEIF
1401 Presque Isle Avenue
Marquette
United States of America
49855

Additional identifiers

Protocol serial number
HS16-786

Study information

Scientific Title
The effects of an 8-week trail versus road running program on neuromuscular performance parameters in healthy middle-aged adults: A two-armed randomized controlled pilot study

Study objectives
Trail running causes more beneficial improvements in neuromuscular performance opposed to road running and thereby helps reduce falls and fall-related injuries. These assumptions are based on the different characteristics of surface type between conditions. Trail running tends to invoke higher challenges for the neuromuscular system, especially regarding coordination, proprioception, and muscle activation.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Northern Michigan University (NMU) Institutional Review Board (IRB) for Research Involving Human Subjects, 02/09/2016, ref: #HS16-786

Study design
interventional simple randomization via random number generator, anonymous, to either trail running intervention or road running control group; single-centre

Primary study design
Interventional

Study type(s)
Prevention

Health condition(s) or problem(s) studied
Falls and fall-related injury due to physical inactivity and accelerated aging-induced functional decrements across all bodily systems, which also compromise the performance of activities of daily living (ADL)

Interventions

All participants are asked to answer the International Physical Activity Questionnaire – Short Form (IPAQ-SF), the Physical Activity Readiness Questionnaire (PAR-Q&YOU), and the American College of Sports and Medicine (ACSM) Risk Stratification to assess their current health and activity levels.

Participants are anonymously assigned by the researcher by simple randomization using a random number generator to either TRAIL (n=20) or ROAD (n=19) and instructed with the same endurance exercise program. Those in the TRAIL group run on a trail. Those in the ROAD group run on a road. Both groups perform a continuous, progressive running program over a period of 8 weeks, 3-5 times a week for 25 - 45 minutes with and without walk breaks. Perceived exertion levels are recorded by each participant in an individually prepared training logbook along with other information, such as duration and mileage of the run, and how they felt after each workout. Pre- and
posttraining program testing sessions are scheduled with the examiner. Therefore, participants reported to the Exercise Science Laboratory of the Northern Michigan University campus, once before and once after the intervention for about 90 minutes each session. Testing was performed for static and dynamic balance, gait analysis, agility, leg strength, and endurance capacity.

The programme consists of eight weeks of gradually increasing running workouts with a total amount of 29 training sessions. Thereof, an adherence rate of a minimum of 80% (24 runs) is required. Exercise training started for each participant after the pretest in September 2016 and was done individually on self-selected outdoor trails and roads at a perceived exertion of 3-4 on Borg CR-10.

Participants are contacted at least once a week by the researcher for an update/feedback on their progress in and experience with the training program. Optional running meetings are held twice a week for each group (total 4 meetings) with me and additional individual coaching meetings were schedule anytime upon request.

After post testing, a final and optional 5km fun event is organised.

The running logs of all participants are collected during the posttesting meeting. All participants received a summary of their results/outcomes from pre- to post testing. Additionally, participants are given the contact information of the study PI case of questions, concerns, or problems post-intervention.

Intervention Type
Behavioural

Primary outcome(s)
All measurements were conducted once for each participant at baseline and a second time within 1 week after completion of the 8-week intervention/training program.
1. Static balance was measured using the BESS (Balance Error Scoring System) test
2. Dynamic balance was measured using the Y-balance test
3. Gait was measured using the Rehagait gait analysis device during level walking at self-selected walking-speeds under single and dual task conditions
4. Agility was measured using the Agility T-Test
5. Strength was measured using the BIODEX Multijoint System 4 Pro for dominant isokinetic leg strength, applying the knee and ankle device (knee extension/flexion, ankle plantar/dorsi flexion)

Key secondary outcome(s))
Predicated maximal oxygen consumption is measured using the Parvo Medics True One 2400 metabolic measurement system via indirect calorimetry. Participants are tested on a treadmill applying the Pepper protocol. Briefly, the protocol starts with an inclination of of 0% and a velocity of 2.5 miles per hour. Exercise intensity increases every minute by elevating either inclination or velocity. Tests are terminated when subjects reached 85% of their predicted VO2max. All posttests are scheduled at the same day and similar times of the day as pretestings.

Completion date
11/12/2016

Eligibility

Key inclusion criteria
1. Between 18-59 years of age
2. Currently sedentary or had not exercised more than twice a week for the last three months
3. If a person has two risk factors related to cardiovascular disease, they are required to have a medical exam and physician consent

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 years

Upper age limit
59 years

Sex
All

Key exclusion criteria
1. If a person had more than two risk factors in the American College of Sports and Medicine (ACSM) Risk Stratification
2. Didn't meet the age range,
3. Worked out more than 2x a week.

Date of first enrolment
01/09/2016

Date of final enrolment
15/10/2016

Locations

Countries of recruitment
United States of America

Study participating centre
Northern Michigan University
Marquette
United States of America
MI, 49855

Sponsor information

Organisation
University of Basel

ROR
https://ror.org/02s6k3f65

Funder(s)

Funder type
Other

Funder Name
Investigator initiated and funded

Results and Publications

Individual participant data (IPD) sharing plan
The participant level data are available upon request from Marisa Heckendorn (Marisa.Heckendorn@unibas.ch).

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Participant information sheet	Participant information sheet	11/11/2025	11/11/2025	No	Yes