# Leg muscle activity patterns during walking in healthy young and old adults

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Main objective: To determine the effects of age and surface inclination on muscle activation during positive and negative joint work.Secondary objective: To determine if walking on an inclined surface magnifies age-differences in muscle activation...

Ethical review	Approved WMO
Status	Pending
Health condition type	Other condition
Study type	Observational non invasive

# Summary

## ID

NL-OMON48092

**Source** ToetsingOnline

**Brief title** Leg muscle activation patterns during walking

## Condition

• Other condition

**Synonym** aging, senescence

#### **Health condition**

veroudering

Research involving Human

## **Sponsors and support**

**Primary sponsor:** Centrum voor Bewegingswetenschappen, Sector F **Source(s) of monetary or material Support:** Ministerie van OC&W

## Intervention

Keyword: aging, biomechanics, gait, muscle activity

## **Outcome measures**

#### **Primary outcome**

Average muscle activity (in mV) of uniarticular leg extensor muscles (i.e.

gluteus maximus, vastus lateralis, vastus medialis, soleus) during positive and

negative joint work separately.

#### Secondary outcome

Average muscle activity (in mV) of biarticular leg muscles (i.e. biceps femoris, semitendinosus, rectus femoris, gastrocnemius medialis) and uniarticular leg flexor muscles (i.e. tibialis anterior) during positive and negative joint work separately.

Time duration of muscle activity (in ms) of leg flexor and extensor muscles during positive and negative joint work separately.

Joint kinetics during gait:

- Negative joint work (hip, knee, ankle) (in J/kg/m)
- Positive joint work (hip, knee, ankle) (in J/kg/m)

#### Subject anthropometrics:

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- Body height
- Body weight

# **Study description**

#### **Background summary**

When walking at similar speeds, profound differences in the walking pattern and its underlying neuromechanical control have been observed between healthy young and old adults. For example, old adults take shorter steps, have more variable steps, lean more forward with their trunk, have a lower ankle range of motion, generate less ankle positive work and greater hip positive work (i.e. redistribution of concentric muscle function), and stiffen their legs more through greater shank and thigh co-contraction. Recently, we observed no age-related differences in the distribution of negative leg joint work or eccentric muscle function during walking. This may be due to the relative maintenance of maximal voluntary eccentric compared to concentric muscle strength in old age. That is because muscle weakness with aging is one likely factor contributing to the reduction in plantarflexor positive work during walking in old age. As both neural and skeletal muscle properties make up force production control and the neural control differs between eccentric and concentric muscle contractions, it seems relevant to determine whether age-related difference in muscle activation patterns during walking are also muscle contraction-specific.

Previous studies that examined muscle activation patterns during specific phases of walking in young and old adults can be used to some extent to formulate hypotheses for muscle contraction-specific activation patterns due to age. That is because a selected phase does not necessarily capture only one muscle contraction type or only a part of it. Nevertheless, one study observed greater soleus, vastus lateralis, and rectus femoris muscle activity in the old during the loading phase (~eccentric function) of level walking, and lower soleus activity during push-off (~concentric function). Another study, however, observed comparable muscle activities of leg extensor muscles during the first half of stance (~eccentric), even when walking downhill. Their results also indicated a tendency for greater soleus activity and greater gluteus maximus activity with increasing uphill walking in the old during the second half of stance. Since downhill and uphill walking compared to level walking respectively accentuates eccentric and concentric muscle function, these previous findings may suggest that the neuromuscular control of concentric muscle function during level and uphill walking but not eccentric muscle function during level and downhill walking is different between young and old

adults.

#### **Study objective**

Main objective: To determine the effects of age and surface inclination on muscle activation during positive and negative joint work. Secondary objective: To determine if walking on an inclined surface magnifies age-differences in muscle activation compared with level walking.

#### Study design

This observational cross-sectional study consists of one session in which a subject is asked to perform functional activities of daily living (i.e. static balance, sit-to-stand, 3-meter walking) and to walk several times on level and inclined surfaces over short distances (i.e.  $\sim$ 10 meters).

#### Study burden and risks

The subjects will visit the Center for Human Movement Sciences once. The subjects are asked to perform activities of daily living. Risks are minimal and comparable to daily life. The subjects can rest in between measurements if necessary.

# Contacts

**Public** Selecteer

Antonius Deusinglaan 1 Groningen 9713AV NL Scientific Selecteer

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# **Trial sites**

## **Listed location countries**

Netherlands

# **Eligibility criteria**

Age Adults (18-64 years) Elderly (65 years and older)

## **Inclusion criteria**

The young subjects will be between 20 and 30 years old, whereas the old subjects will be 65+ years old. All the

participants will be generally healthy and able to walk without an assistive aid (i.e. walker, cane).

## **Exclusion criteria**

Mini Mental State Examination score < 24, cardiovascular disorders that causes risk with exercise, high blood pressure that is uncontrolled by medication (> 180/115), previous stroke, Parkinson's disease, Alzheimer's disease or other forms of dementia, treatment of cancer within the last three months, severe asthma or chronic bronchitis, musculoskeletal disorders that disables a person from normal walking, joint replacement or a fracture present in one of the lower extremities, severe diabetes with neuropathy, visual impairments that disables normal mobility, BMI > 30 kg/m2, pregnancy.

# Study design

## Design

Study type: Observational non invasive		
Masking:	Open (masking not used)	
Control:	Uncontrolled	
Primary purpose:	Prevention	

## Recruitment

NL

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Recruitment status:	Pending
Start date (anticipated):	15-02-2019
Enrollment:	32
Туре:	Anticipated

# **Ethics review**

Approved WMO	
Date:	04-02-2019
Application type:	First submission
Review commission:	METC Universitair Medisch Centrum Groningen (Groningen)

# **Study registrations**

# Followed up by the following (possibly more current) registration

No registrations found.

## Other (possibly less up-to-date) registrations in this register

No registrations found.

## In other registers

**Register** CCMO ID NL68499.042.18