The impact of collagen peptide versus free amino acid ingestion on myofibrillar and connective tissue protein synthesis rates at rest and during recovery from exercise

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To assess the impact of collagen peptides versus free amino acids on myofibrillar and connective tissue protein synthesis rates in muscle and skin obtained during recovery from exercise and rest in vivo in humans.

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Interventional

Summary

ID

NL-OMON50954

Source
ToetsingOnline

Brief title
Coll-AA Study

Condition

- Other condition

Synonym
Muscle health, Skin health

Health condition

Muscle and connective tissue research (no disorders)

Research involving
Human

Sponsors and support

Primary sponsor: Universiteit Maastricht
Source(s) of monetary or material Support: Ministerie van OC&W,Tessenderlo Group NV

Intervention

Keyword: Muscle, Protein, Resistance exercise, Skin

Outcome measures

Primary outcome

To assess the impact of collagen peptides versus free amino acid ingestion

after exercise on myofibrillar and connective tissue protein synthesis rates in

muscle tissue obtained during recovery from exercise in vivo in humans.

Secondary outcome

- To assess the impact of collagen peptides versus free amino acid ingestion on

connective tissue protein synthesis rates in skin.

- To characterize plasma amino acid availability following ingestion of

collagen protein versus free amino acids.

Study description

Background summary

Dietary protein ingestion stimulates muscle protein synthesis rates and further augments the muscle protein synthetic response to a single bout of exercise. The anabolic properties of dietary protein ingestion appear to be largely attributed to the post-prandial rise in circulating plasma essential amino acid concentrations, with leucine being of particular interest. In support, protein supplementation during recovery from exercise has been shown to augment the gains in muscle mass and strength following more prolonged exercise training . Stable isotope methodology is generally applied to assess the impact of protein

ingestion on muscle protein synthesis rates in vivo in humans. Incorporation rates of stable isotope labeled amino acids in muscle tissue are assessed following primed continuous labeled amino acid infusions at rest or during recovery from exercise. The focus is generally directed towards the post-prandial increase in the synthesis rates of contractile muscle protein, referred to as myofibrillar protein. As a consequence, there is little information on the impact of nutrition and exercise on the synthesis rates of connective tissue protein in skeletal muscle. The collagenous extracellular matrix of muscle tissue has recently regained much interest for its key role in transferring the forces generated by the contractile filaments throughout the muscle and onto the ligaments, tendons, and bone. This connective tissue matrix has been shown to express a high level of plasticity and collagen protein synthesis rates have been shown to rapidly increase in muscle tissue following exercise. However, the impact of protein ingestion with or without prior exercise on connective tissue protein synthesis rates in muscle remains to be established.
Dairy protein is often considered the preferred protein source to maximize myofibrillar protein synthesis rates. However, dairy protein contains relatively little glycine and proline and may, therefore, be ineffective to support an increase in connective tissue protein synthesis rates at rest or during recovery from exercise. Recently, we demonstrated that milk protein ingestion actually lowers plasma glycine availability, implying that connective tissue remodeling during recovery from exercise may be compromised by low plasma glycine availability. A promising alternative are collagen peptides, which are rich in glycine and proline and have, therefore, been proposed as the preferred protein source to support connective tissue remodeling. While the impact of collagen peptide ingestion on connective tissue protein synthesis rates in skeletal muscle and skin tissue remains to be established, recent studies have reported that collagen peptide supplementation can further augment skeletal muscle mass and strength gains following prolonged exercise training. Furthermore, it has been suggested that collagen peptides have anabolic properties that extend beyond the provision of their corresponding amino acid precursors. Whether collagen peptides contain specific bioactive peptides that can further stimulate myofibrillar and/or connective tissue protein synthesis rates in muscle and skin has never been addressed in vivo in humans.

Study objective

To assess the impact of collagen peptides versus free amino acids on myofibrillar and connective tissue protein synthesis rates in muscle and skin obtained during recovery from exercise and rest in vivo in humans.

Study design

Double-blind, parallel-group, placebo-controlled intervention study

Intervention

Participants will perform unilateral resistance exercise followed by the ingestion of either 30 g of collagen peptides, 30 g free amino acids (matching the profile of collagen peptides), or a non-caloric placebo (flavored water). Continuous intravenous tracer infusion will be applied, and plasma, muscle and skin samples will be collected in order to assess the muscle and skin protein synthetic response.

Study burden and risks

The burden and risks involved in participating in this experiment are small. Insertion of the catheters in a vein is comparable to a normal blood draw and the only risk is a small local hematoma. Muscle and skin biopsies will be obtained under local anesthesia by an experienced physician. The muscle biopsy may cause some minor discomfort, which is comparable to muscle soreness or the pain one has after bumping into the corner of a table. The area of the skin biopsy might feel a bit uncomforable the next days, but will only result in minor discomfort. During the experimental trial 17 blood samples (~170mL total) will be obtained. The total amount of blood collected is less than half the amount of a blood donation and will be completely restored in approximately 1 month. The stable isotope amino acids tracers that will be infused intravenously during the experimental trial are produced according to GMP standards and are safe for human use. Participants will be instructed on proper utilization of the exercise equipment by the researcher to prevent injury. Participants will visit the University two times. The first visit will involve a screening visit (3 h), during which the eligibility of the participant will be assessed and a DEXA scan will be performed. Additionally, participants will be familiarized with single leg exercise on the leg press and leg extension machine. The single leg one repetition maximum (1RM) will be determined on the same machines. For the second visit (experimental trial) participants are required to come to the University in a fasted state, not having consumed any food or beverages (except for water) as from 22:00 the evening before. Also, 2 days prior to the experimental trial participants need to record their food intake and activities performed. During these 2 days participants are not allowed to perform heavy physical exercise or drink alcohol. Filling out the food and activity log properly will take the participant 30-45 min each day. There is no direct benefit for the participants, except from their contribution to scientific knowledge.

Contacts

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Trial sites

Listed location countries

Netherlands

Eligibility criteria

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

Inclusion criteria

- Males and females
- Aged between 18-35 years
- Healthy, recreationally active (participating in recreational sports activities * 3 times per week)
- BMI 18.5 - 30 kg/m2
- No physical limitations (i.e. able to perform all activities associated with daily living in an independent manner).

Exclusion criteria

- Pregnant
- Third generation oral contraceptives
- Hormone replacement therapy
- Smoking
- Musculoskeletal disorders
- Use of any medications known to affect protein metabolism (i.e. corticosteroids, non-steroidal anti-inflammatories, or prescribed acne

medications).
- Participation in any structured regular exercise program
- Chronic use of gastric acid suppressing medication or anti-coagulants
- Unstable weight over the last three months
- Pathologies of the gastrointestinal tract
- Blood donation in the past 2 months

Study design

Design

Study type:	Interventional
Intervention model:	Parallel
Allocation:	Randomized controlled trial
Masking:	Double blinded (masking used)
Control:	Placebo
Primary purpose:	Other

Recruitment

NL

Recruitment status:	Recruitment stopped
Start date (anticipated):	07-12-2021
Enrollment:	57
Type:	Actual

Ethics review

Approved WMO

Date:	18-05-2021
Application type:	First submission
Review commission:	METC academisch ziekenhuis Maastricht/Universiteit Maastricht, METC azM/UM (Maastricht)

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	ID
CCMO	NL76260.068.20