ISRCTN49416083 https://doi.org/10.1186/ISRCTN49416083

The difference between Ester-C and ascorbic acid in adult women and men

Submission date
27/04/2023

Recruitment status
No longer recruiting

Registration date
03/05/2023

Overall study status
Completed

Last Edited
03/07/2025

Condition category
Other

[_] Prospectively registered
[_] Protocol
[_] Statistical analysis plan
[X] Results
[_] Individual participant data

Plain English summary of protocol

Background and study aims
This study compares Ester-C® and ascorbic acid (AA) by analyzing their effects on leukocyte (white blood cell) and neutrophil (a type of white blood cell) function. Studies have shown that acute doses of 1000 mg of Ester-C® led to higher concentrations of AA in leukocytes for up to 24 hours compared to AA alone. Neutrophils are the most abundant white blood cells in the human body and require AA to protect them from oxidative damage. Studies have shown that low levels of vitamin C can impair neutrophil function, while supplementation can improve it. The researchers hypothesize that acute supplementation with Ester-C® will lead to better leukocyte and plasma AA levels and improved neutrophil phagocytic function compared to AA alone.

Who can participate?
Healthy male and female adults aged 18 to 60 years old

What does the study involve?
This study involves repeat blood draws after the ingestion of a low or high dose of either Ester-C (which provides AA) or AA by itself in hopes of evaluating comparative leukocyte AA accumulation kinetics. Moreover, to evaluate comparative leukocyte AA accumulation in the body, plasma AA accumulation kinetics, and neutrophil phagocytic function.

What are the possible benefits and risks of participating?
The study cannot promise any benefits to the participants. However, possible benefits include increased insight into their personal health. Possible risks of the study include a small amount of pain when the needle and/or catheter is inserted into the vein as well as some bleeding and bruising during the blood draws. The participant may also experience some dizziness, nausea, and/or faint if they are unaccustomed to having blood drawn. Risks that are possible but unlikely include infection, nerve damage and puncturing an artery instead of a vein. The treatments may cause possible nausea, vomiting, esophagitis, heartburn, abdominal cramps, gastrointestinal obstructions, diarrhea, fatigue, headache, insomnia and sleepiness. Although allergic reactions to vitamin C are rare, symptoms may include; itching or swelling in the face, lips or mouth, skin rashes, hives, asthma, sinus pressure, nasal congestion, shortness of breath, wheezing, sinus headaches, diarrhea, vomiting, nausea and abdominal pain. One of the risks of being in this study

is that personal information could be lost or exposed. This is very unlikely to happen, and the researchers will do everything possible to ensure that private information is protected.

Where is the study run from?
The study is run through the Exercise & Sport Nutrition Laboratory (ESNL) at Texas A&M University (USA)

When is the study starting and how long is it expected to run for?
December 2020 to December 2022

Who is funding the study?
The Bountiful Company, a Nestlé Health Science Company (USA)

Who is the main contact?
Dr Richard Kreider, (Texas A&M University), rbkreider@tamu.edu

Contact information

Type(s)
Scientific

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Study information

Scientific Title
A cross-over comparator study between Ester-C and ascorbic acid evaluating acute pharmacokinetics in adult women and men

Study objectives
We hypothesize that acute supplementation with Ester-C will elicit superior leukocyte and plasma ascorbic acid (AA) pharmacokinetics, and neutrophil phagocytic function in comparison to equimolar doses of vitamin C from AA.

Ethics approval required
Old ethics approval format

Ethics approval(s)
Approved 26/04/2021, Texas A&M University Institutional Review Board (IRB), (Blocker Bldg 204C, 155 Ireland, College Station, Texas 77843-1186, USA; +1 979-458-4067; irb@tamu.edu), ref: IRB2021-0020, 119277

Primary study design
Interventional

Study design
Single-centre randomized controlled crossover counterbalanced pharmacokinetic study

Study type(s)
Treatment

Health condition(s) or problem(s) studied
Evaluate leukocyte ascorbic acid (AA) accumulation kinetics in healthy adult males and females.

Interventions
Participants will be randomized using the stratified randomization method based on age, gender and body weight. Participants will donate a fasting blood sample and then consume the assigned treatment of either 250 mg of Ester-C (providing 250 mg of ascorbic acid - AA) or 250 mg of AA if on the lower dose protocol or either 500 mg of Ester-C (providing 500 mg of AA) or 500 mg of AA if on the higher dose protocol. Follow-up blood samples will then be collected after 1, 2, 4, and 8 hours. Participants will then complete an adverse event questionnaire and an unblinding questionnaire. Participants will be given a low-vitamin C-containing standardized meal to consume after providing the 8-hour blood sample and before retiring for the night. The participants will return to the lab in a fasted condition the next morning for a 24-hour blood sample and be provided with a standardized breakfast. They will then finally donate a 32-hour post-ingestion blood sample. The participants will then be asked to observe a 7-28 day washout period (tested at the same time of menstrual cycle for women) and repeat the experiment with the alternative supplement.

Intervention Type
Supplement

Primary outcome(s)

The primary outcome measure is to evaluate comparative leukocyte ascorbic acid (AA) accumulation kinetics following acute doses, of different amounts, from two sources of AA measured in blood samples using High-Performance Liquid Chromatography (HPLC) at baseline, 0, 1, 2, 4, 8, 24 and 32 hours post supplementation

Key secondary outcome(s)
The secondary outcome measure is to evaluate comparative leukocyte ascorbic acid (AA) accumulation kinetics, plasma AA accumulation kinetics, and neutrophil phagocytic function following acute doses, of different amounts, from two sources of AA measured in blood samples using imaging flow cytometry at baseline, 0, 1, 2, 4, 8, 24 and 32 hours post supplementation.

Completion date
19/12/2022

Eligibility

Key inclusion criteria
1. Willingness to provide voluntary, written, informed consent to participate in the study
2. Healthy adults aged 18 - 60 years
3. Body Mass Index (BMI) between 18 - 30 kg/m2
4. Non-smokers or have stopped smoking for more than one year
5. Willingness to consume a low-vitamin C diet during the study

Participant type(s)
Healthy volunteer

Healthy volunteers allowed
No

Age group
Adult

Lower age limit
18 Years

Sex
All

Total final enrolment
95

Key exclusion criteria
1. Pregnancy, breastfeeding, or wishing to become pregnant during the study (confirmed via a negative pregnancy test)
2. Prescription or over-the-counter (OTC) products known to interact with vitamin C within 72 hours of randomization and during the trial, such as aspirin, non-steroidal anti-inflammatory drugs (NSAIDs), aluminium-containing antacids and iron
3. Proton pump inhibitors (e.g., Prilosec, Nexium, Prevacid) within the past month
4. Multivitamins or other dietary supplements containing vitamin C within 7 days of randomization and during the trial

5. Diagnosed with type 1 or 2 diabetes
6. Gastroesophageal reflux disease within the past 3 months
7. History of significant gastrointestinal disease or a history of malabsorption, or any other condition which, in the Investigator's opinion, may adversely affect the participant's ability to complete the study or its measures or which pose a significant risk to the participant
8. Uncontrolled heart disease, hypertension, thyroid disease, cancer, neurological disease, or untreated psychotic or major depressive disorder that may limit their participation

Date of first enrolment
27/04/2021

Date of final enrolment
27/10/2021

Locations

Countries of recruitment
United States of America

Study participating centre
Exercise & Sport Nutrition Laboratory
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Sponsor information

Organisation
The Bountiful Company, a Nestlé Health Science Company

Funder(s)

Funder type
Industry

Funder Name
Nestlé Health Science

Alternative Name(s)
Nestlé Health Science S.A.

Funding Body Type
Private sector organisation

Funding Body Subtype
For-profit companies (industry)

Location
United States of America

Results and Publications

Individual participant data (IPD) sharing plan
The datasets generated during and/or analysed during the current study are/will be available upon request from Dr. Richard Kreider, rbkreider@tamu.edu.

IPD sharing plan summary
Available on request

Study outputs

Output type	Details	Date created	Date added	Peer reviewed?	Patient-facing?
Results article		02/10/2024	03/07/2025	Yes	No