Dose-Response Impact of Geranylgeraniol (GG) Supplementation on Muscular Strength, Body Composition, Sex Steroid Hormones and CoQ10 Levels in Healthy Men and Women

IRB #: __25-35__

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Laboratory: _Exercise and Performance Nutrition Laboratory, Lindenwood University___

Study Overview

The purpose of this study is to examine how supplementation with geranylgeraniol (GG) affects muscular strength and endurance, body composition, and aerobic fitness in healthy, physically active men and women GG is a naturally occurring compound that the body uses to support muscle health, energy production, and the creation of important molecules such as coenzyme Q10 and certain hormones. These processes are essential for maintaining muscle function, recovery, and overall physical performance.

As people age, natural levels of GG gradually decline, which may contribute to changes in muscle mass, strength, and metabolic health. Supplementing with GG may help support these systems, but limited research has examined its effects in active adults. This study aims to better understand whether GG supplementation can help support physical performance and muscle health over time.

Participants will take either a GG supplement or a placebo daily for approximately eight weeks. GG is considered safe for healthy adults, and all study visits and testing are supervised by trained research staff to prioritize participant safety.

Participation at a Glance

- Total Study Duration: 8 Weeks
- Number of Visits: 4 Visits
- Time per Visit: 30-120 min each
- Supplementation: participants are assigned randomly to consume either the active (150-GG or 300-GG) or placebo. These are all in capsule form and will be taken daily.
    - Active:
        - 150-GG: 150 mg of Geranylgeraniol + Purified Olive Oil
        - 300-GG: 300 mg of Geranylgeraniol
    - Placebo: Purified Olive Oil
- Participant Pre-Visit Requirements:
    - 8-hour food and fluid fast
    - Abstain from caffeine for 12 hours
    - Abstain from strenuous exercise for 24 hours
    - Wear athletic clothing and shoes
- Compensation: $500 with Direct Deposit + $25 referral bonus

How to Get Started

1. Complete the ***screening form***.
2. Our team will review your info and contact you with eligibility.
3. If eligible, we will schedule Visit 1 (see next section for details).
4. Visit 1 includes: informed consent, intake paperwork (health history, study

questionnaires), baseline body composition, heart rate, blood pressure, and instructions for collecting a fecal sample and completing a 4-day food log before Visit 2.

Study Visit(s) Outline

	Visit 1 (4-28 days before Visit 2)	Visit 2 (Day 1)	Visit 3 (Day 28)	Visit 4 (Day 56)
Visit Length	~30 mins	90-120 mins	90-120 mins	90-120 mins
Consent	X			
Screening	X			
Height & Body Mass	X	X	X	X
Resting Heart Rate & Blood Pressure	X	X	X	X
Body Composition (DEXA)	X		X	X
Body Water Scan	X		X	X
4-Day Food Record		X		X
Fecal Sample Collection		X		X
Blood Sample Collection		X	X	X
Treadmill VO_2Peak Assessment		X	X	X
Questionnaires: Mood, Quality of Life		X		X
Muscular Strength (Leg/Chest Press)		X	X	X
Muscular Endurance (Leg/Chest Press)		X	X	X
Supplement Daily	Two daily capsules (placebo, 150 mg GG, 300 mg GG)			
Daily Supplement Diary	Online log to track daily study supplement consumption			
Supplementation Compliance	X	X	X	X
Review Adverse Event Monitoring	X	X	X	X
Provide Compensation and Results				X

Procedure Details

- **DEXA Scan** – A DEXA scan is a low-dose X-ray that measures bone, muscle, and body fat. Participants lie still on a padded table while a scanner passes over the body. The scanner does not touch the body and the participant will not feel anything. The test takes about 7 minutes to complete.
- **Body Water Assessment** – This test estimates body water levels using a safe, very small electrical signal. Electrodes are placed on the wrist and ankle after cleaning the skin with alcohol. Participants are asked to remain still during the measurement. Participants do not feel the signal. The test will take a total of about 5 minutes.
- **4-Day Food Log –** This log helps researchers understand typical dietary intake. Participants will record all food and drinks consumed over the four days prior to their Visit 2 and Visit 4 using an online food record system. Completing the log typically takes 10-15 minutes per day.
- **Fecal Sample Collection –** This sample helps researchers evaluate how the study supplement may influence gut health and metabolism. Participants will collect a small fecal sample at home within 24 hours before Visit 2 (Day 1) and again within 24 hours before Visit 4 (Day 56). Samples are collected before any in-lab exercise testing using materials and step-by-step instructions provided by the research team.
- **Blood Sample Collection –** A trained research team member will collect blood from a vein in the arm using standard procedures at the start of Visits 2-4. Each blood draw takes about 5-10 minutes, and all samples are handled and stored using approved safety protocols. Blood samples are collected to help researchers understand how the body responds to supplementation. These samples are used to measure markers of health, hormones, and inflammation.
- **VO_2Peak Assessment –** This test measures aerobic fitness and how efficiently the body uses oxygen during exercise. Participants walk or run on a treadmill while wearing a mask that measures breathing, with heart rate monitored throughout. The test gradually becomes more challenging and continues until the participant chooses to stop due to fatigue. The test lasts approximately 20 minutes, including warm-up.
- **Questionnaires –** Participants will complete short questionnaires related to mood, overall well-being, and quality of life. These surveys help researchers understand how participants feel throughout the study. Completion time is approximately 10–20 minutes.
- **Muscular Strength Assessment –** Muscular strength will be measured using standard upper- and lower-body exercises: bench press and leg press. Participants will complete a warm-up followed by progressively heavier lifts to determine their maximum strength for each exercise. Trained staff will supervise all testing to ensure proper technique and safety. Strength testing typically takes 30–45 minutes.
- **Muscular Endurance Assessment -** Muscular endurance will be assessed using the bench press and leg press by having participants perform as many repetitions as possible with a fixed weight. This test helps determine how well muscles perform during repeated effort. The endurance portion takes approximately 15–20 minutes.

Compensation & Benefits

- Total Compensation Amount: $500
- Referral Bonuses: $25; Current or former participants may also receive a $25 referral bonus for each referred participant who completes the study.
- Compensation Distribution: paperwork will be completed and filed during the final research visit. It typically takes 2-4 weeks for the university and your bank account to process.
- Non-monetary Benefits:
    - Body Composition Results
    - VO_2Peak (aerobic/endurance capacity) Results
    - Muscular Strength and Endurance Results
- You will receive no direct benefits for completing this study. We hope what we learn may benefit other people in the future.

Risks & Safety

- *Privacy and Confidentiality*: We are collecting data that could identify you, such as name, phone number, and email address. Every effort will be made to keep your information secure. Only research team members can see any data that may identify you.

- *Risk of Adverse Events from Supplementation*: This risk will be minimized through the use of standardized production processes and appropriate engineering controls to prevent contamination. Participants will be monitored for changes in heart rate and blood pressure and will be asked to self-report any adverse events during each visit.

- *Risk of Infection from Blood Draw*: This risk will be minimized by maintaining a sterile laboratory environment, employing proper phlebotomy techniques, and ensuring the correct handling and disposal of all phlebotomy equipment.

- *Risk of Musculoskeletal Injury/Soreness*: Participants will be involved in exercise and performance testing as part of this study. The risk of injury will be minimized by having trained study team members supervise and conduct the testing. These team members are trained in CPR/AED and/or certified as strength and conditioning specialists. Additionally, physical risks associated with intense exercise will be minimized by conducting a health appraisal during screening and ensuring that all participants are already accustomed to physical activity.

- *Radiation Exposure:* You will have three DEXA scans completed to assess your body composition. This scan will expose you to a dose of radiation that is considered by medical experts to be small or trivial. The dose you will receive is similar to the same amount of radiation you will be exposed to by living in a populated community.

Frequently Asked Questions (FAQs)

Q: Will I receive my test results?

A: Yes. You will be provided with a summary of your results for body composition, muscular strength and endurance, and peak aerobic and endurance capacity (VO_2Peak) at the end of your participation.

Q: Can I withdraw from the study at any time?

A: It is always your choice to participate in this study. You may withdraw at any time. You may choose not to answer any questions or perform tasks that make you uncomfortable. If you decide to withdraw, you will not receive any penalty or loss of benefits. If you would like to withdraw from a study, you can contact the research team at epnl@lindenwood.edu or (636) 949-4676; the Principal Investigator, Chad Kerksick, PhD directly at (636) 627-4629 or ckerksick@lindenwood.edu. You may also contact the laboratory coordinator, Anthony Hagele at (636) 949-4785 or ahagele@lindenwood.edu.

Q: Will my information be kept private?

A: We will do everything we can to protect your privacy. We do not intend to include information that could identify you in any publication or presentation. Any information we collect will be stored by the researcher in a secure location. The only people who will be able to see your data are: members of the research team, qualified staff of Lindenwood University, representatives of state or federal agencies.

Q: What if I miss a visit?

A: Contact the research team as soon as possible. We will attempt to reschedule within the study timeframe, when possible.

Q: Do I have to be an athlete or highly trained?

A: No. You do not need to be a competitive athlete to participate. This study is open to physically active individuals who regularly exercise for at least 30 minutes on at least 4 days a week at a moderate effort level.

Q: Can I bring a friend or family member to visits?

A: Yes, you are welcome to bring a friend or family member to your visits. They will not take part in the study procedures, but they are welcome to wait in the designated areas during your appointment.

Q: What if I have dietary restrictions or allergies?

A: If you have dietary restrictions or allergies, please let the research team know. We will review them with you to ensure the study procedures and any provided products are safe and appropriate for you.

Location

Lindenwood University
Exercise and Performance Nutrition Laboratory (EPNL)
Fieldhouse, Rm 126
209 S Kingshighway St., Saint Charles, MO 63301