

The Potential Use of Lemongrass (*Cymbopogon citratus*) Essential Oil to Modulate the Contents of the Gut Microbiome: A Literature Review



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Abstract

The gut microbiome plays a significant role in nutrient metabolism, maintenance of the structural integrity of the gut mucosal barrier, and protection against pathogens. There are a great quantity of different species that contribute to the importance of the gut microbiota in mammals. While research into the composition and role of the gut microbiota is ongoing, there are known links between the gut microbiome and mood, mental health, autoimmune diseases, endocrine disorders, skin conditions, and cancer. The microbiome can be disrupted by parturition, breast feeding, medications (including antibiotics), and diet. Certain dietary supplements may be used to support a balanced gut microbiome and improve general health. Lemongrass essential oil is known to have antibacterial properties, to prevent wound infection, and to provide protection against damage in the stomach. While essential oils have been growing in popularity, little research has been done to investigate the effects of essential oils, including lemongrass essential oil, on the gut microbiome. Research in this area is required to determine whether essential oils can be used as a dietary supplement. A dietary supplement of lemongrass essential oil may impact gut microbiome by possibly decreasing certain concentrations of bacteria more significantly than others with its antibacterial and antifungal properties.

Background

Lemongrass is a tall, perennial, tropical grass native to Maritime Southeast Asia that can grow up to 10 ft. tall. Some common uses include: as an antioxidant, as an antimicrobial, as an anti-inflammatory agent, to promote healthy digestion, and in cholesterol regulation⁴.

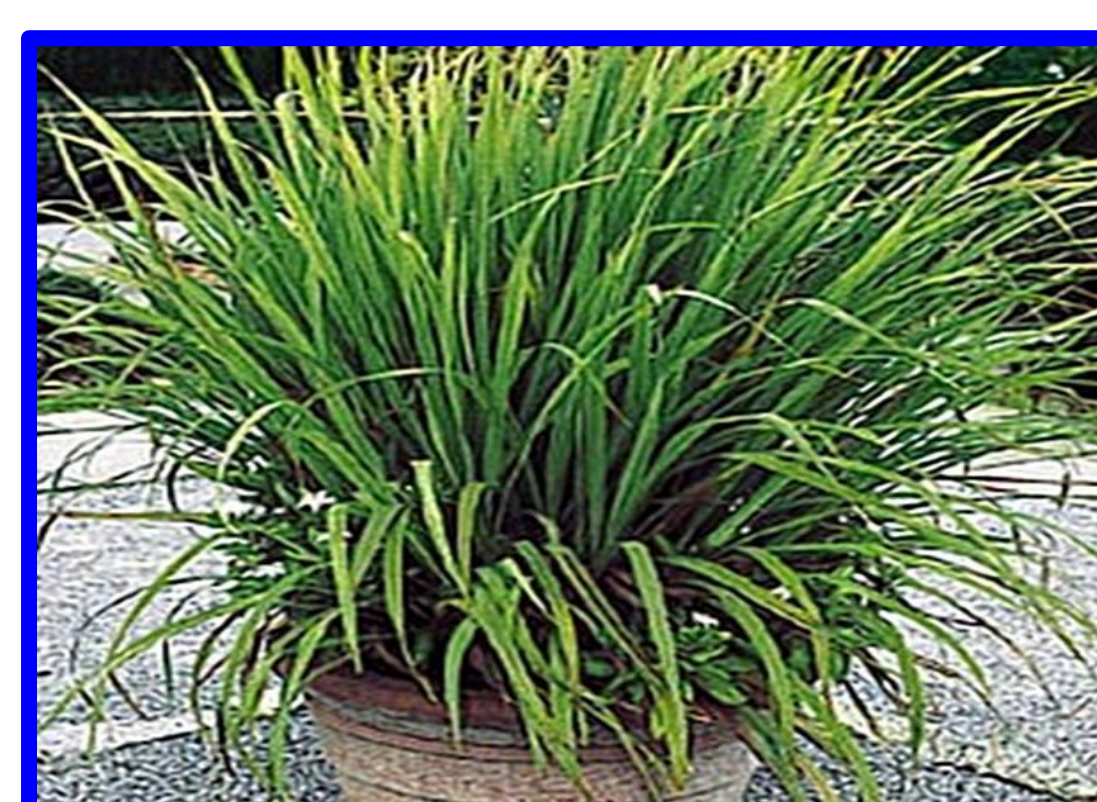
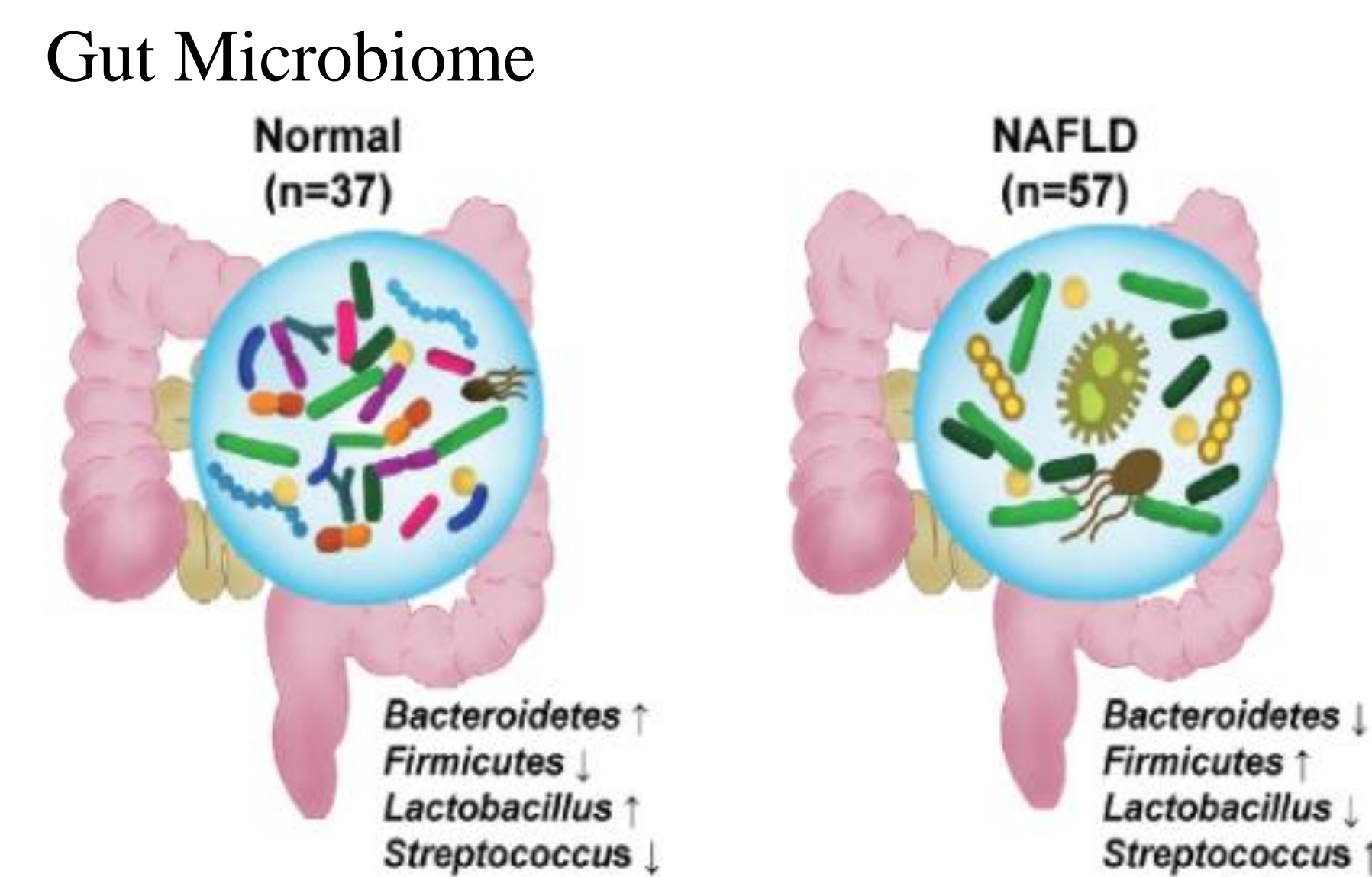


Figure 1: *Cymbopogon Citratus* (Lemongrass)

Essential oils are concentrated hydrophobic liquids containing volatile chemicals from plants (*Cymbopogon citratus*)

Background Cont.



Methanogens

- Methane
- Removes excess hydrogen and fermentation products
- High concentration - discomfort

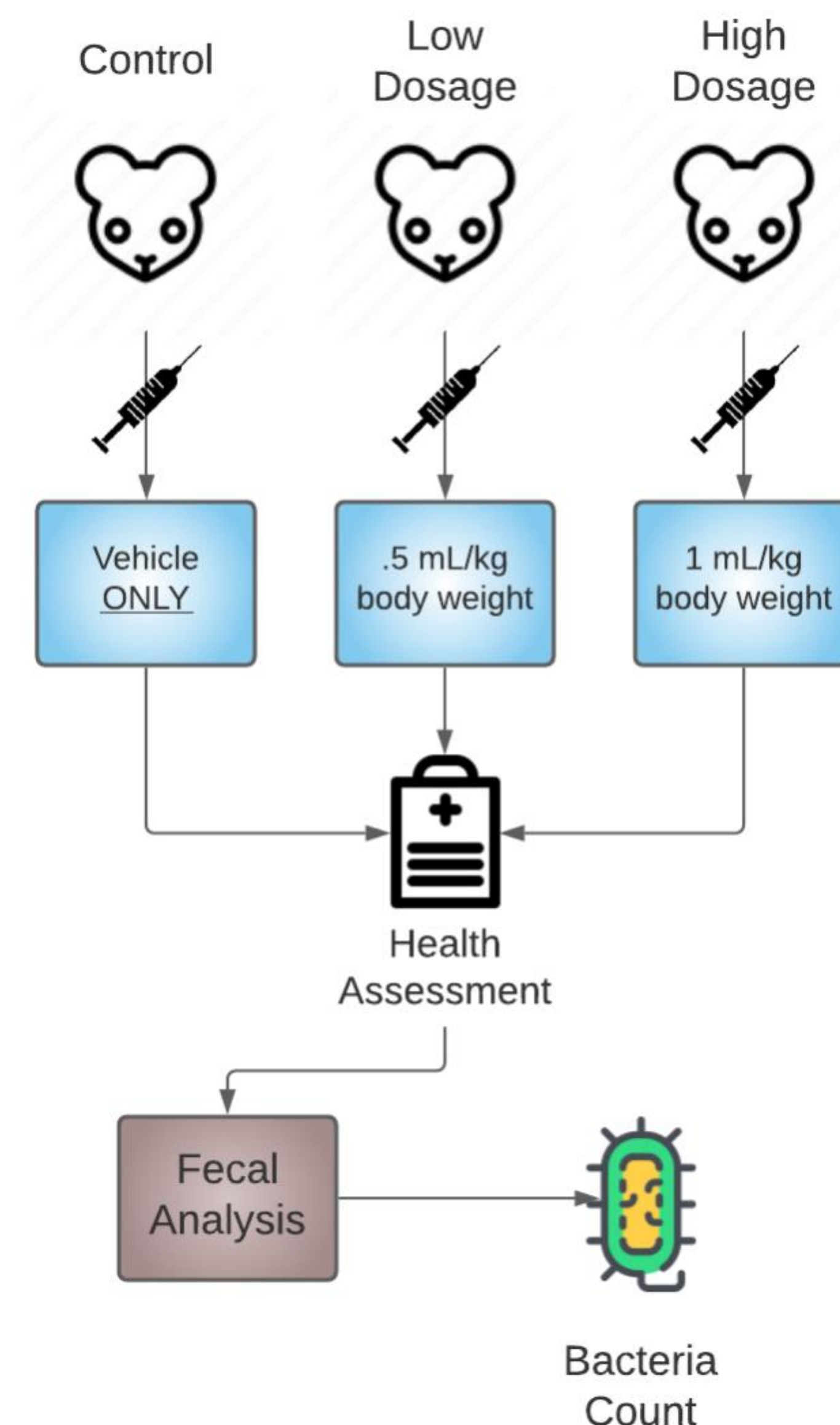
Bacteroides

- Energy source - sugars (plant material)
- Aid in immunization
- High concentration - infections

Lactobacillus

- Protection against...
 - Type 2 diabetes
 - Inflammatory bowel disease

Experimental Design



Methods

Administering Lemongrass Essential Oil

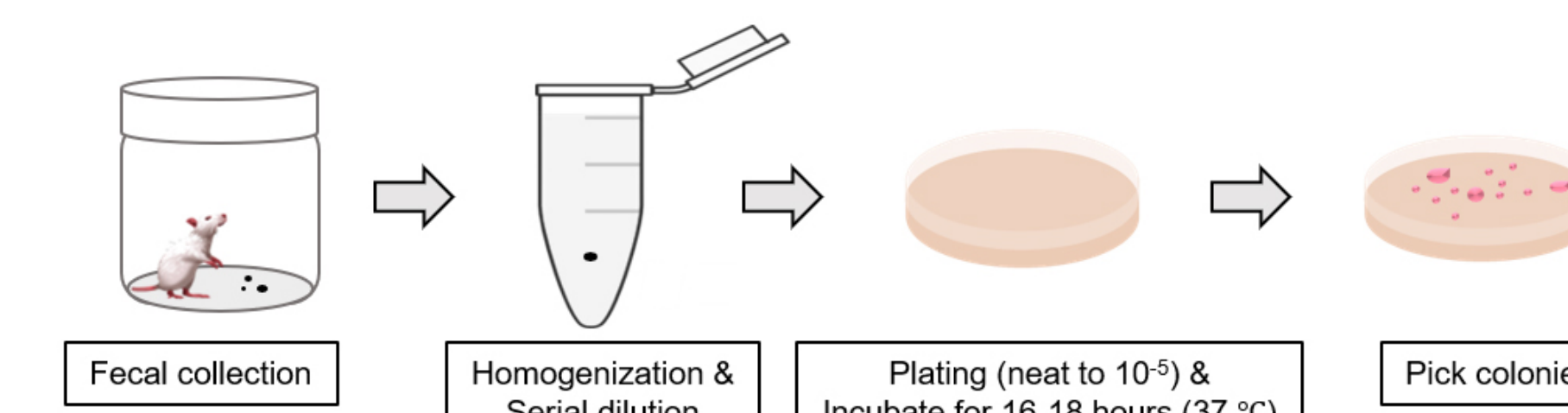


Figure 3: Oral Gavage Example

A stainless steel bulb tipped gavage needle or a flexible cannula or tube is attached to a syringe and used to deliver the compound directly into the stomach. Restraining will be necessary.

Fecal Bacterial Analysis

Every week the fecal pellets will be isolated, cultured, and quantified for comparison using selective media and culture conditions.



Types of Selective Media & Culture Conditions

Most gut microbiota need to be cultured in an anaerobic environment (Gas-pak)*

Selective Media

- MRS Agar
 - Lactobacillus
- Bacteroides Bile Esculin (BBE)
 - Bacteroides*
- SAB Medium (Defined Medium)
 - Methanogens *

Rat Health Assessment

Recording the weight, coat, active or passive behavior, if any discharge is present, consistency and coloration of their fecal matter, and teeth daily will be necessary to understand how the rats are handling the lemongrass essential oil.

Serial Dilution Technique

The serial dilution-agar plate method will be used to quantify the bacterial load of specific bacterial species in the stool.

Methods (cont.)

Serial Dilution Technique

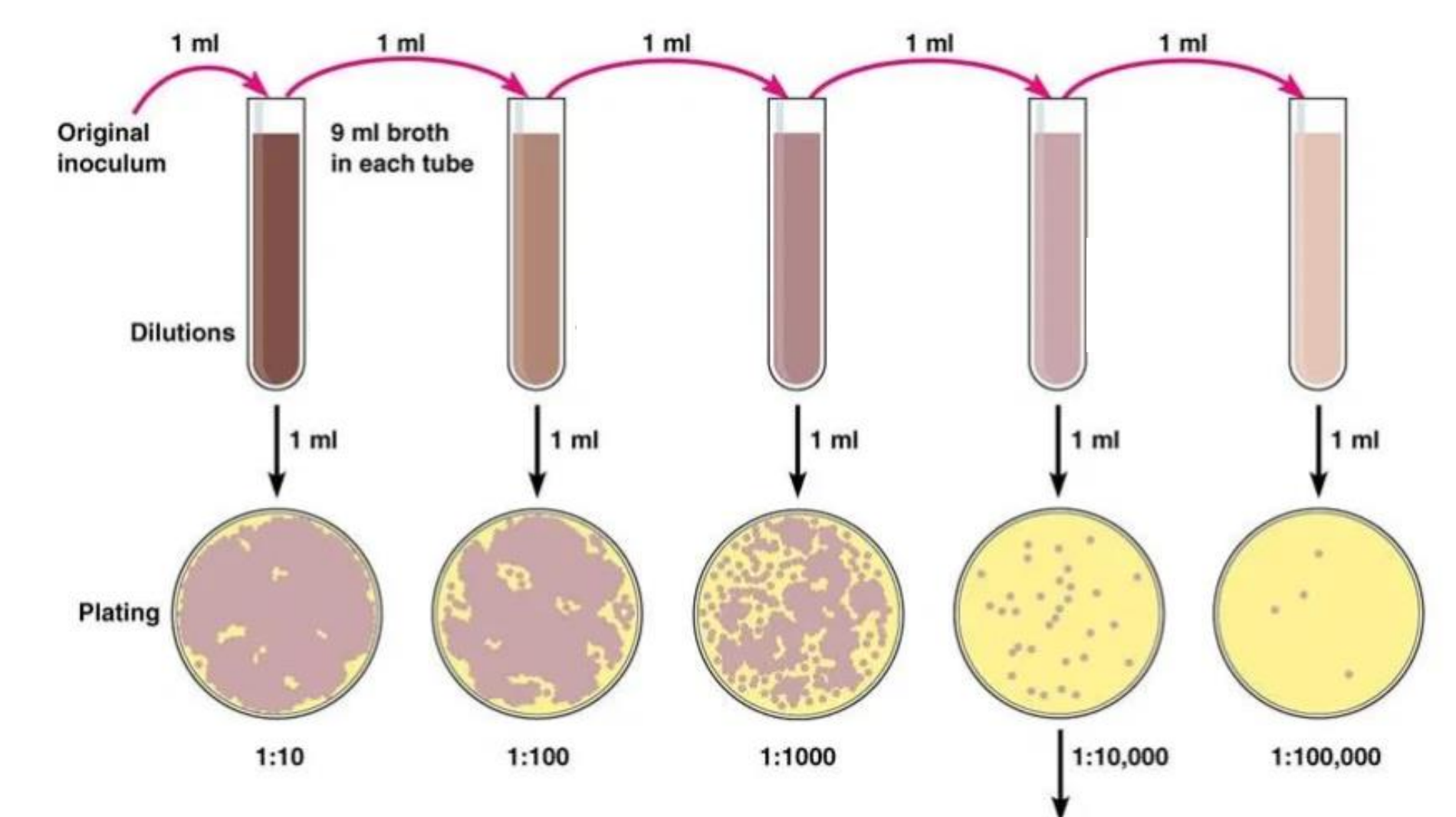


Figure 5: Serial Dilution

Anticipated Outcomes

Lemongrass essential oil is expected to promote and sustain a healthier gut microbiome and improve the overall health of the animals in a dose dependent manner by discovering new ratios of gut microbiota. The composition of bacteria may decrease due to antibacterial properties of lemongrass essential oil.

Significance

We would better understand whether ingestion of lemongrass will effectively help maintain a stable microbiome, or if the antimicrobial properties could select against the beneficial normal composition of the gut. With this experiment, the hope is to establish correlations between lemongrass essential oil exposure, new microbiome composition ratios, and overall health.

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