

# Alpine farming and the diversity of the human nasal microbiome - The ALM feasibility study

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<b>Registration date</b> 23/10/2025	<b>Overall study status</b> Completed	<input type="checkbox"/> Statistical analysis plan <input type="checkbox"/> Results
<b>Last Edited</b> 23/10/2025	<b>Condition category</b> Other	<input type="checkbox"/> Individual participant data <input checked="" type="checkbox"/> Record updated in last year

## Plain English summary of protocol

### Background and study aims

This study investigates whether spending time in a traditional alpine farming environment can positively affect human health—especially by influencing the nasal microbiome. The microbiome refers to the community of tiny organisms that live in and on the human body. These microbes, especially those in the nose and respiratory tract, are thought to play an important role in training and supporting the immune system.

Previous research has shown that human who grow up on farms are less likely to develop conditions like allergies, asthma, and autoimmune diseases. This so-called "farm effect" may be linked to early and frequent exposure to harmless environmental microbes found in farm air, soil, animals, and food. However, it is still unclear whether similar benefits can be seen in adults who were not raised in rural or farming settings.

This feasibility study aims to find out whether a short, one-week stay on a traditional alpine pasture (known as an "Alm" in Austria) can improve health indicators and change the nasal microbiome in healthy adult volunteers with no prior farming exposure. It also explores whether any such changes persist over time.

### Who can participate?

The study invites healthy adults aged 18 to 65 years who have not lived or worked on a farm in the past five years, have no formal training in agriculture, and do not live with someone who works in farming.

People with uncontrolled health conditions—such as severe heart, lung, metabolic, or immune disorders—or those taking antibiotics, corticosteroids, or immunosuppressants are excluded. Participants must not have had cancer treatment in the past five years, and they must not have a history of substance abuse. Both men and women can take part.

### What does the study involve?

The study includes a seven-day stay on a working alpine farm in the Riedingtal Valley (Salzburg, Austria). During the stay, participants take part in simple, everyday farming tasks like milking cows, making cheese, caring for animals and helping with pasture maintenance.

There is no fixed work schedule and participants are not under pressure to perform specific tasks. The setting is deliberately kept natural and unstructured to reflect real-life conditions. All participants eat the same regionally typical meals, including unprocessed dairy products,

fresh bread, and locally sourced foods. This diet is part of the natural exposure to the alpine environment and its microbial diversity.

The following measurements are taken before and after the alpine stay: Nasal swabs to study changes in the microbiome, Blood samples to check for signs of inflammation, stress hormones, and immune function, Tests of physical fitness, Questionnaires about quality of life, mental well-being, and connection to nature.

What are the possible benefits and risks of participating?

Potential benefits include improved physical and mental well-being through time spent in nature, health gains from physical activity and fresh air and a chance to learn about traditional alpine life and food.

There are minimal risks. Blood draws may cause mild temporary discomfort. Physical activities are moderate and adapted to the participant's ability. There is no medical treatment involved, so side effects are unlikely. Participation is voluntary, and individuals can leave the study at any time without penalty.

Where is the study run from?

The study is run by the Institute for Ecomedicine at Paracelsus Medical University, located in Salzburg, Austria.

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

March 2022 to September 2022.

Who is funding the study?

The study is funded by the Government of Salzburg through its WISS (Science and Innovation Strategy) program, under the project titled "Almen und Gesundheit" (Project Code F2000128).

Who is the main contact?

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## Contact information

### Type(s)

Public, Scientific, Principal investigator

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## Additional identifiers

## Clinical Trials Information System (CTIS)

Nil known

## ClinicalTrials.gov (NCT)

Nil known

## Protocol serial number

1042/2021

# Study information

## Scientific Title

Ecological exposure through alpine farming: a feasibility study on the diversity of the human nasal microbiome in "Alm-Naive" Persons

## Acronym

ALM

## Study objectives

Primary Hypothesis (H1): Exposure to the alpine farming environment (the "Alm-Exposome") in previously non-exposed urban individuals ("Alm-naive") leads to measurable and potentially sustained alterations in the diversity and composition of the human nasal microbiome.

Secondary Hypotheses (H2–H3):

Exposure to the alpine environment induces systemic physiological, molecular, and psychological benefits in urban individuals, potentially including:

- \* Reduced inflammatory biomarkers (e.g., IL-6, CRP)
- \* Improvements in cardiometabolic health, such as lipid profile and VO<sub>2</sub>max
- \* Enhanced quality of life

## Ethics approval required

Ethics approval required

## Ethics approval(s)

approved 02/05/2022, Ethics Committee of the federal state of Salzburg, Austria (Pfeifergasse 7, Salzburg, 5020, Austria; +43 662 8042-2929; ethikkommission@salzburg.gv.at), ref: 1042/2021

## Study design

Monocentric prospective single-arm observational feasibility study

## Primary study design

Observational

## Study type(s)

Diagnostic

## Health condition(s) or problem(s) studied

Physiological, immunological, and psychological effects of a seven-day nature-based lifestyle intervention in healthy urban adults.

## Interventions

The intervention comprises a seven-day immersive exposure to a traditional alpine agrarian environment in the Riedingtal Valley, Salzburg, Austria. This setting—characterized by elevated microbial biodiversity, low levels of anthropogenic pollution, and culturally intact mountain pastures (“Almen”)—is selected to provide ecologically valid, high-altitude exposure representative of Eastern Alpine biotopes.

Participants, all naïve to agricultural contexts, engage daily in a range of non-standardized farming and pastoral activities alongside local alpine farmers. These include voluntary participation in hand-milking, artisanal cheese production, pasture maintenance (e.g., fencing, clearing), and animal husbandry. No fixed schedules or prescriptive tasks are imposed, preserving the real-world complexity and ecological authenticity of the exposure.

Dietary intake remains uniform across participants and consists of regionally typical, unprocessed foods—primarily raw or minimally processed dairy products, freshly baked breads, and other locally sourced alpine provisions. This dietary component is intentionally embedded within the broader cultural and microbial ecology of the alpine environment.

The intervention thus constitutes a multimodal, ecologically grounded exposomic stimulus, integrating environmental microbial contact, dietary commensals, moderate physical activity, and psychosocial interaction, with the aim of capturing the full spectrum of health-relevant alpine exposures under naturalistic conditions.

Total duration of observation 1 week.

## **Intervention Type**

Other

## **Primary outcome(s)**

Human nasal microbiome diversity, assessed via 16S rRNA gene sequencing at baseline (t0) and again after the intervention on day 7

## **Key secondary outcome(s)**

At baseline (t0) and again after the intervention on day 7:

1. Lipid metabolism markers (HDL cholesterol, non-HDL cholesterol, total cholesterol, triglycerides)
2. Differential blood count
3. Inflammatory markers (C-reactive protein and interleukin-6)
4. Chester Step Test to estimate VO<sub>2</sub>max
5. Subjective wellbeing and quality of life (WHO-5 Wellbeing Index , EQ-5D-5L visual analogue scale, Nature Relatedness Scale )

## **Completion date**

10/09/2022

## **Eligibility**

### **Key inclusion criteria**

1. Age: 18-65 years
2. Gender: women and men

3. "Alm-naïve": No previous residence, occupation or internship in an agricultural environment
4. No exposure to: Agricultural jobs (professional/residential) in the last 5 years, Agricultural schools/training, Shared living with farmers

**Participant type(s)**

Healthy volunteer

**Healthy volunteers allowed**

No

**Age group**

Adult

**Lower age limit**

18 years

**Upper age limit**

65 years

**Sex**

All

**Total final enrolment**

29

**Key exclusion criteria**

1. Uncontrolled diseases:

1.1. Metabolic: fasting blood sugar  $\geq 140$  mg/dL

1.2. Cardiovascular: RR systolic  $\geq 180$  mmHg, diastolic  $\geq 110$  mmHg

1.3. Psychiatric: PHQ-9  $>9$  (depressive symptoms); Immunological: Pathological disorders of the immune system

2. Medication use: Antibiotics; cortisone preparations, immunosuppressants

3. Active cancer or therapy within the last 5 years

4. Substance abuse: Drugs, alcohol, nicotine

**Date of first enrolment**

01/06/2022

**Date of final enrolment**

31/08/2022

**Locations****Countries of recruitment**

Austria

**Study participating centre**

Paracelsus Medical University Salzburg, Institute of Ecomedicine  
Strubergasse 22

Salzburg  
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5020

## Sponsor information

### Organisation

Paracelsus Medical University

### ROR

<https://ror.org/03z3mg085>

## Funder(s)

### Funder type

Government

### Funder Name

Salzburger Landesregierung

### Alternative Name(s)

Federal State of Salzburg

### Funding Body Type

Government organisation

### Funding Body Subtype

Local government

### Location

Austria

## Results and Publications

### Individual participant data (IPD) sharing plan

Further details to the data presented in this study are available on reasonable request from the corresponding author after publishing all data.

### IPD sharing plan summary

Available on request

### Study outputs

<b>Output type</b>	<b>Details</b>	<b>Date created</b>	<b>Date added</b>	<b>Peer reviewed?</b>	<b>Patient-facing?</b>
<a href="#">Study website</a>	Study website	11/11/2025	11/11/2025	No	Yes