APPLE POMACE AS A SUSTAINABLE SOURCE OF PREBIOTICS

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SUMMARY

1. Introduction

The circular economy and bio-residues recycling strategies

2. Objectives

Recovery of compounds of interest from apple bio-residues

3. SDGs

Sustainable Development Goals

4. Methodology

Prebiotic and antioxidant activities

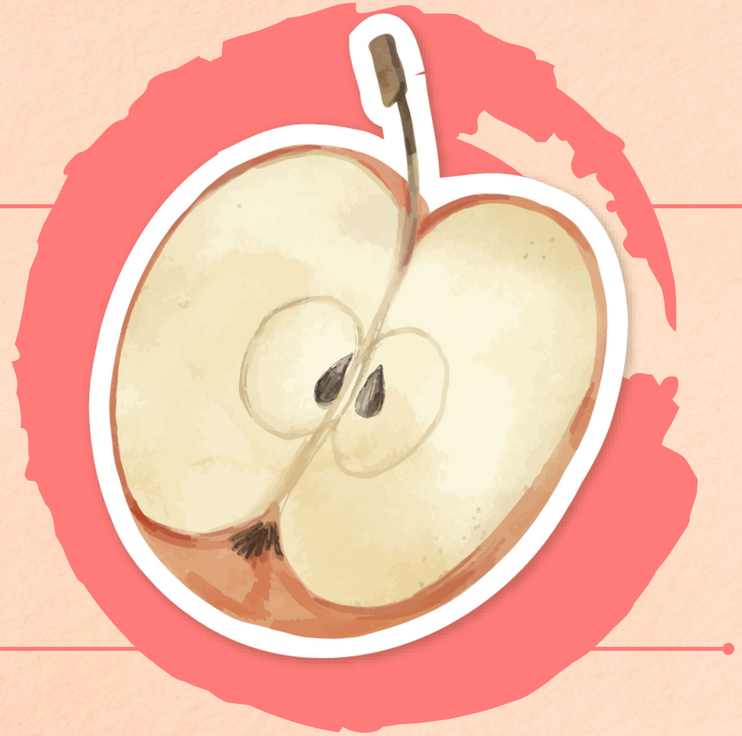
5. Results

6. Conclusions

INTRODUCTION

Malus domestica Borkh.

Most popular fruit worldwide;



This process generates a solid residue, apple pomace (AP), representing around 30% of the original fruits;

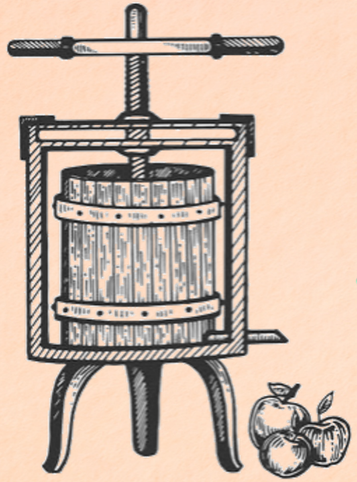
Raw material for producing apple juice concentrate and cider;

AP contains a wide range of healthy compounds;

INTRODUCTION

Apple’s processing chain following a linear approach

Apple cultivation



Apple pressing

Cider or juice

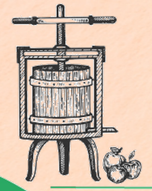
Apple pomace

INTRODUCTION

Apple's processing chain following the circular economy guidelines

PHASE 1

Apple cultivation



PHASE 2

Pressing fresh apple

Clarifying

Fermentation

PHASE 3

Obtaining bio-residues:
Apple pomace

PHASE 4

Extraction of value-added compounds

PHASE 5

Aplication in food or nutraceutical products

PHASE 6

Entirely use of residues: zero waste

MAIN OBJECTIVES

1.

Investigate apple pomace (AP), namely its health-promoting compounds, to exploit its full potential;

2.

Explore the potential of using bio-residues from apple production following a circular economy concept to extract high-added-value compounds with bioactive potential.

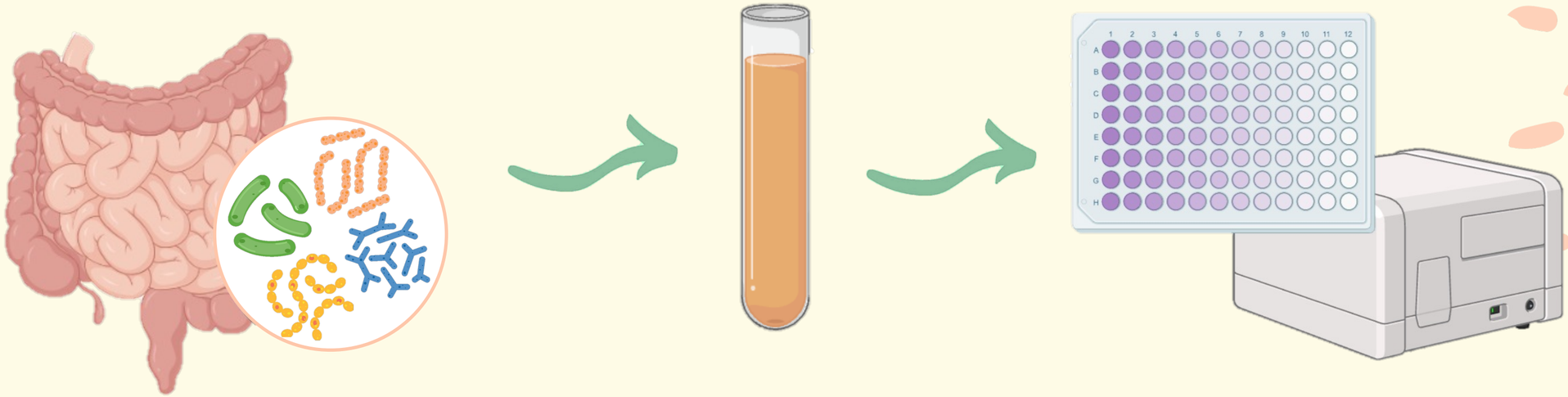
SUSTAINABLE DEVELOPMENT GOALS

- Develop a new functional food or functional ingredient to valorize the apple pomace, and promote healthier life habits (SDGs 2 and 3);
- Encouraging a green, circular economy and valuing resources through a sustainable, underexplored bio-residue with compounds of interest and significant potential (SDG 12).

METHODOLOGY

1. Prebiotic activity of apple pomace compared with positive controls: glucose, inulin, and fructooligosaccharides (FOS).

In vitro method



Lactobacillus casei;
Lactobacillus plantarum;
Lactobacillus acidophilus LA-5;
Bifidobacterium animalis spp. lactis Bb12.

AP at 2% in MRS broth
+
Inoculum
(5 x 10^5 CFU/mL)

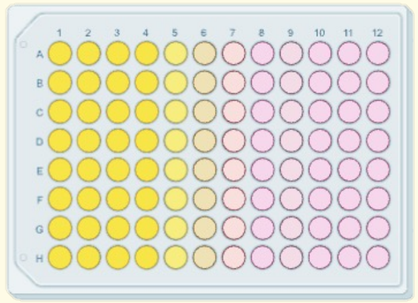
Absorbance (620 nm) under incubation at 37 °C for 48 hours

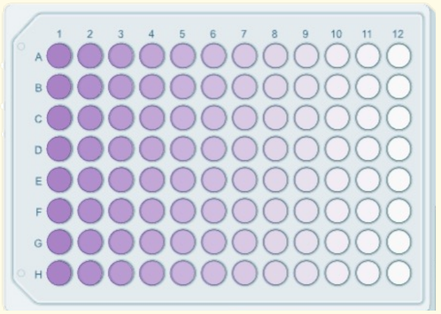
METHODOLOGY

2. Antioxidant activity: *in vitro* assays

The ability to inhibit the formation of thiobarbituric acid reactive substances (TBARS) in brain cell homogenates;

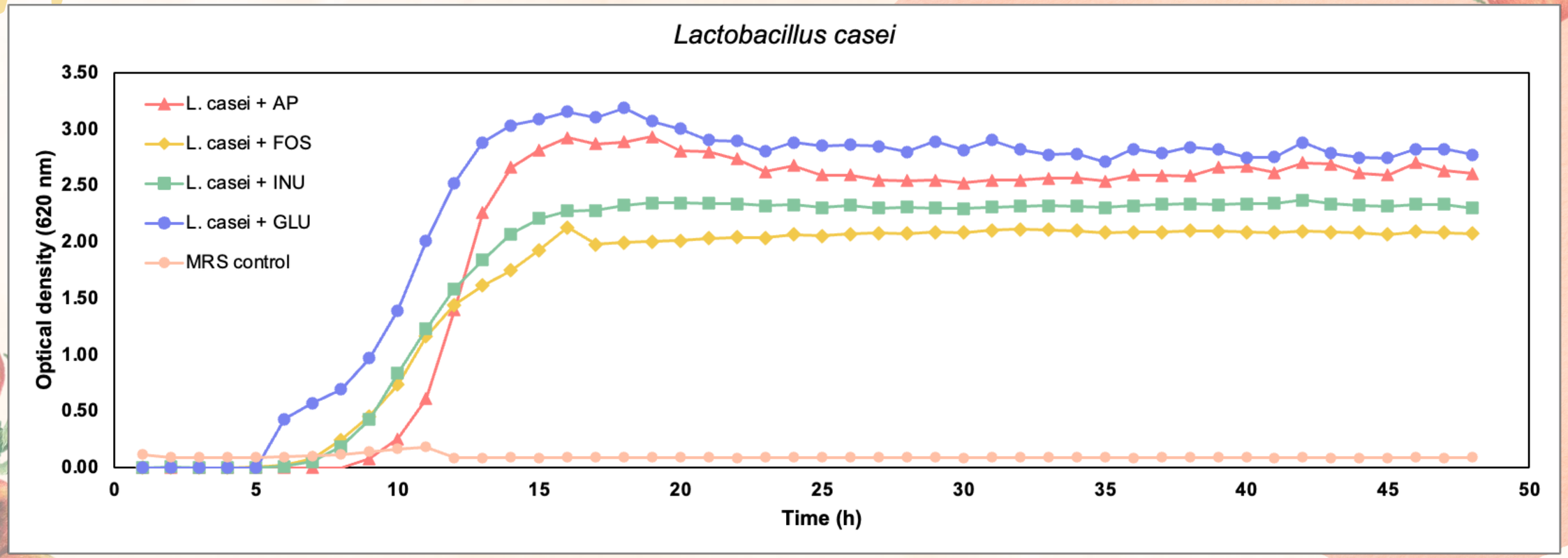
Oxygen radical absorbance capacity (ORAC).





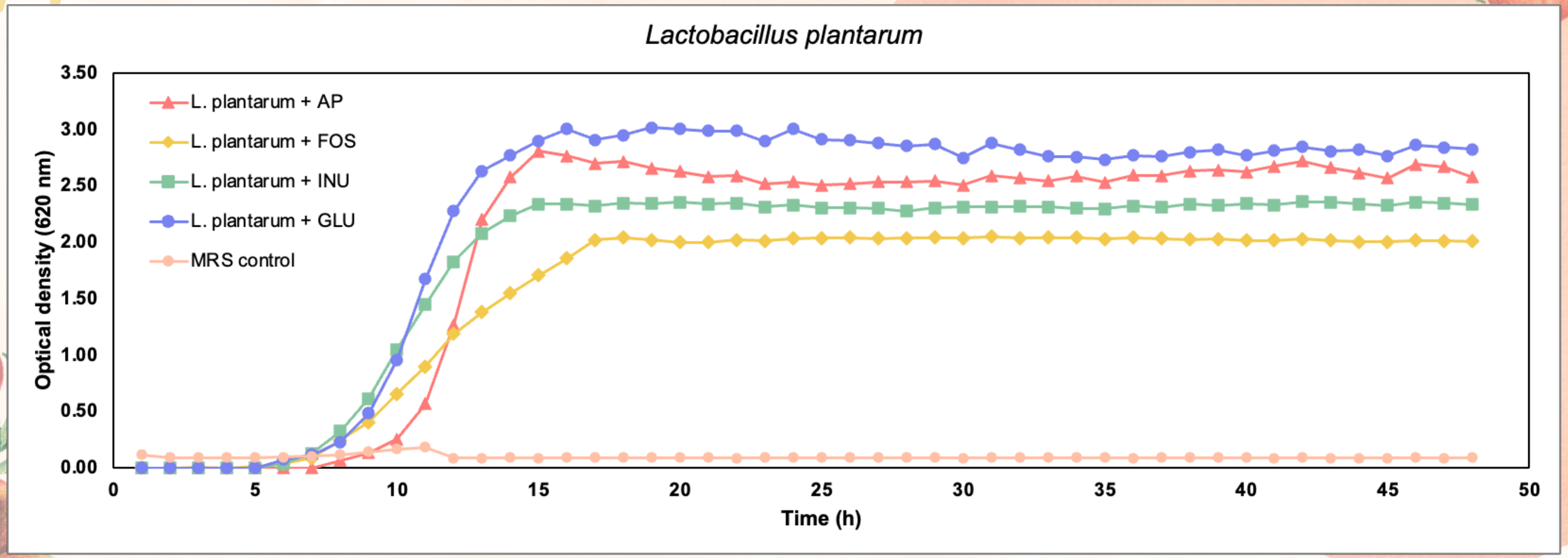
PREBIOTIC RESULTS

Glucose is an ideal growth substrate because it is an easily accessible carbon source for microorganisms while inulin and FOS have recognized probiotic activity.



Values surpassing 2.5 in the stationary phase and the exponential phase beginning after 8 hours.

PREBIOTIC RESULTS



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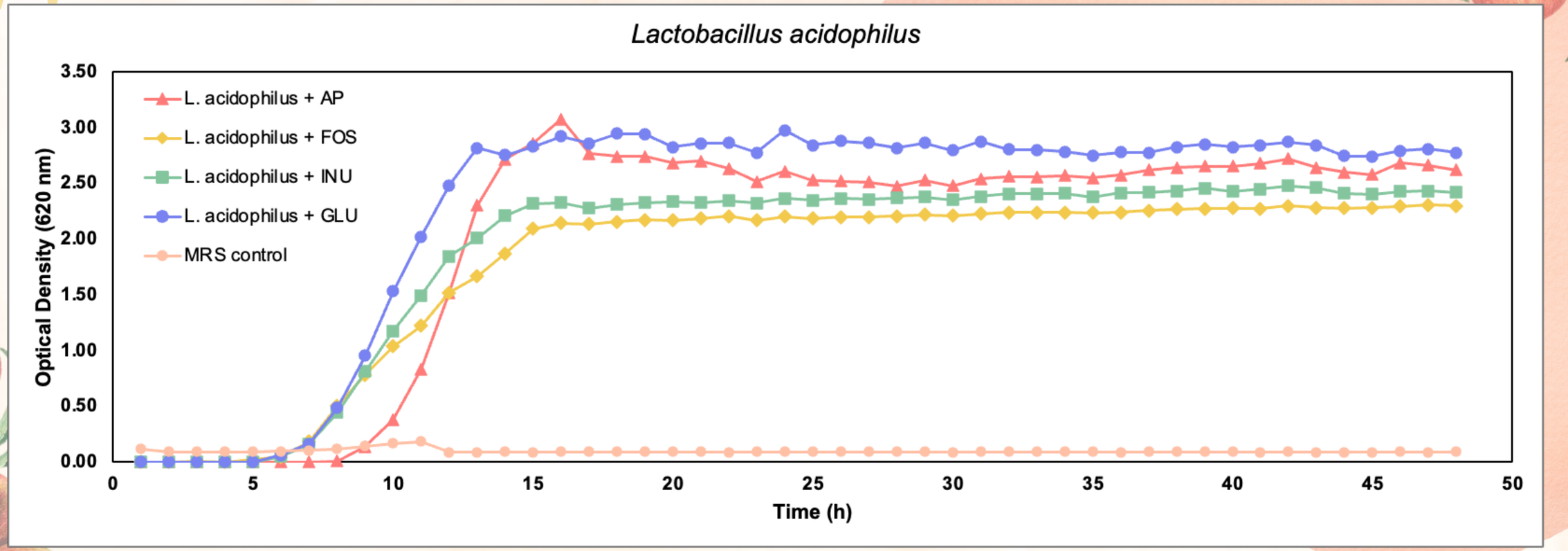

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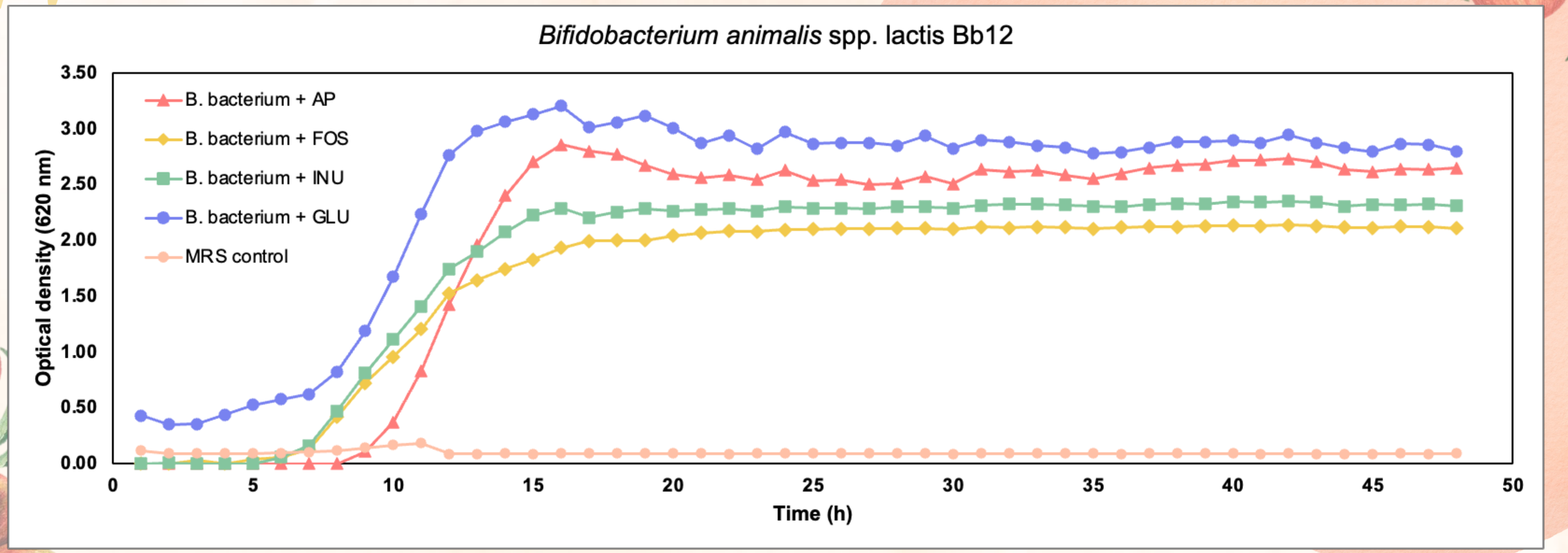
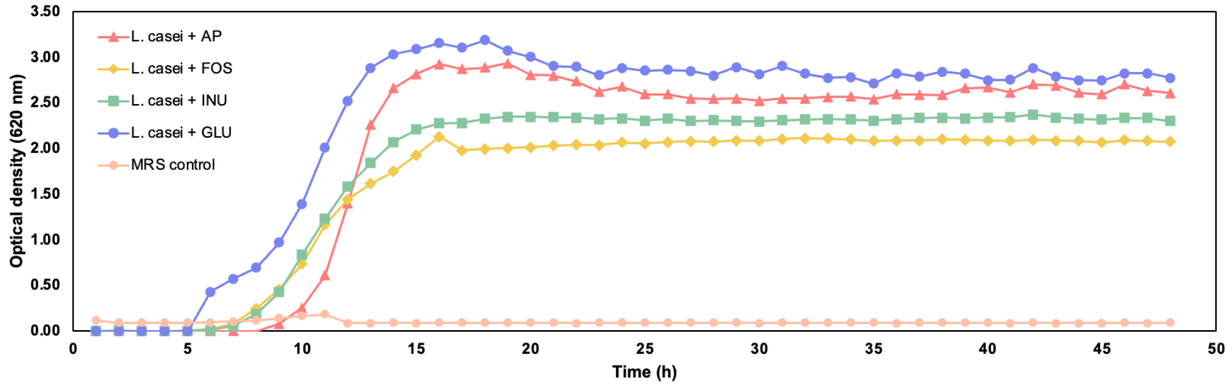


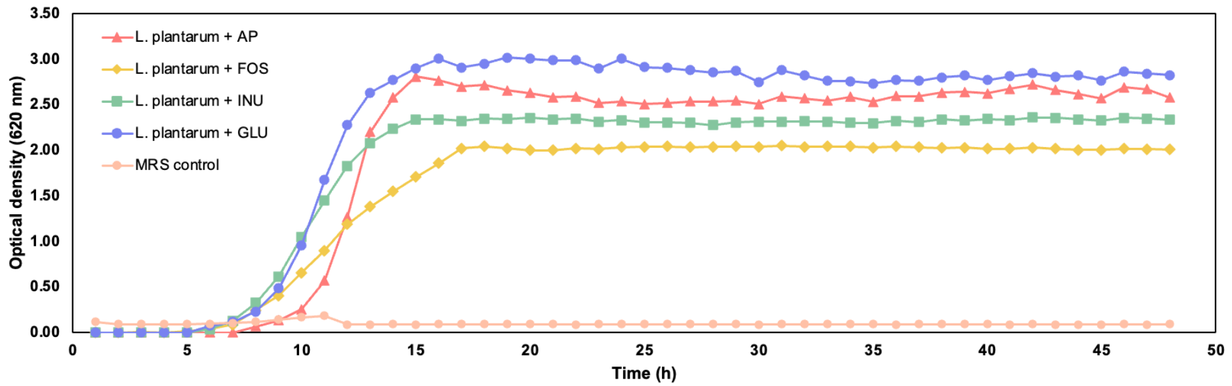
Values surpassing 2.5 in the stationary phase and the exponential phase beginning after 8 hours.

PREBIOTIC RESULTS

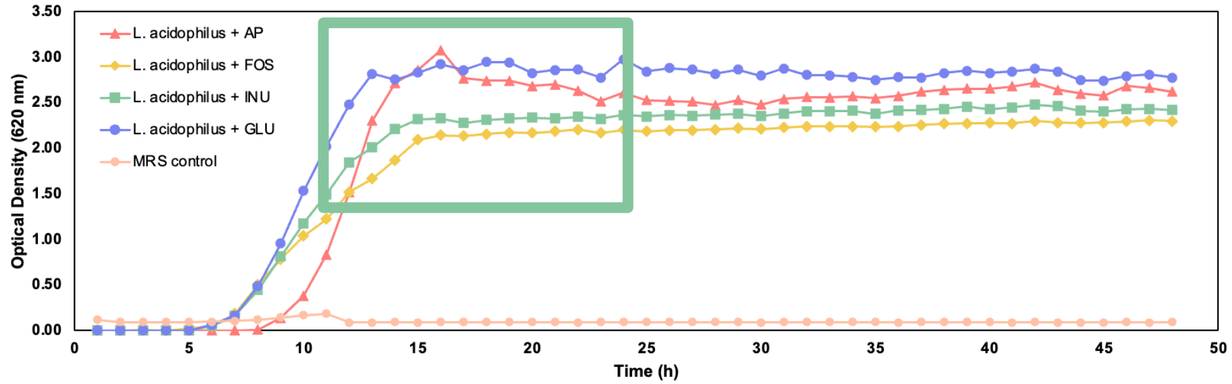
Lactobacillus casei



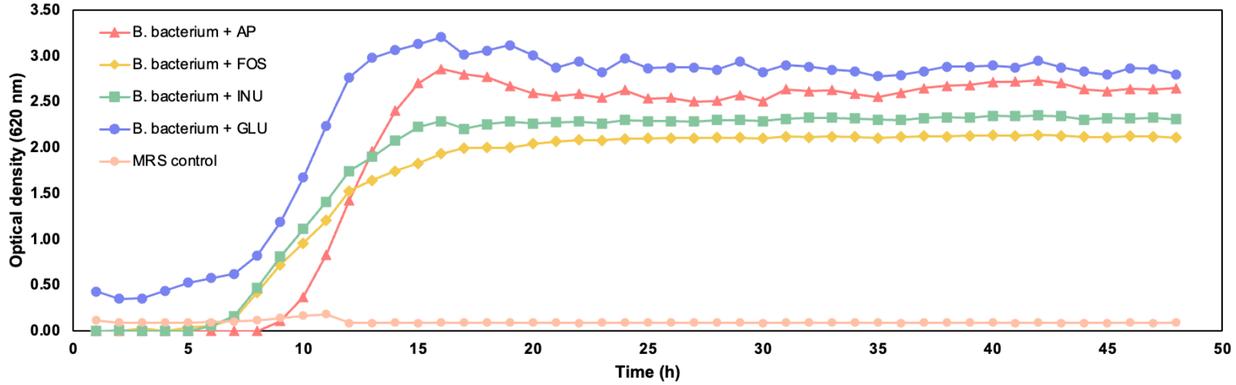
Lactobacillus plantarum



Lactobacillus acidophilus



Bifidobacterium animalis spp. lactis Bb12



ANTIOXIDANT RESULTS

- There are a lot of methodologies available to evaluate the antioxidant capacity;
- The existence of a wide range of antioxidant compounds in the extracts.

ORAC assay

161 μmol TE/g

(Trolox equivalent)

TBARS assay

EC_{50} = 646 μg/mL

Minimum concentration of the extract required to inhibit 50% of lipid peroxidation

CONCLUSIONS

High potential to be exploited as an innovative and competitive source of bioactive compounds;

AP demonstrated efficacy in supporting the growth of diverse probiotic strains;

Potential for inclusion in dietary supplements and healthy applications to improve gut health;

Apple pomace can diversify the industry through its conversion into high-value products, contributing to the circular economy.

Acknowledgments

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