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OPTIMIZATION OF FERMENTATION PARAMETERS FOR THE GROWTH OF *Lactobacillus plantarum* 299v IN LUPINO (*Lupinus mutabilis*. Sweet)

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INTRODUCTION

Dairy products have conventionally been used as carriers of probiotics. However, lactose intolerance, high cholesterol level, allergenic milk proteins and the trend towards vegetarianism motivated the search for non-dairy products as potential probiotic carriers. Within them, the legumes such as lupin (*Lupinus mutabilis* Sweet) offer many advantages. They are grown and consumed all over the world and are rich sources of proteins, vitamins, and minerals. In addition, they contain some specific prebiotics, i.e., nondigestible carbohydrates, such as soluble fibers, oligosaccharides and resistant starches. Vegetable beverage with probiotics offer several physiological benefits: There is an increase in the concentration of carboxylic acids in feces (mainly acetic acid and propionic acid[1].The concentration of Gram-negative anaerobes, *Enterobacteriaceae*, and sulfite-reducing clostridia tends to decrease [2]. There is a significant reduction of fibrinogen and LDL-cholesterol concentrations in serum [3].

The aim of this study was to establish the optimum lupine-water ratio and sweetener concentration for the growth of *Lactobacillus plantarum* 299v, a probiotic used in vegetable matrices, using a response surface model (RSM).

MATERIALS AND METHODS

Raw material: *Lupinus mutabilis*. Sweet, ecotype Altagracia from Otuzco (La Libertad) Perú, was provided by Program of Legumes of National Agraria La Molina University.

Methods:

Counts of probiotics: *Lactobacillus plantarum* 299v counts were determined following the method described [4]. MRS agar was used and incubated aerobically at 37 C for 72 h.

pH: The pH measurements were made with a digital pH meter.

Proximate analysis: A.O.A.C. (2016).

Fig.1. General research scheme. **a)** Conditioning of *Lupinus mutabilis*. Sweet, **b)** Probiotic strain (*Lactobacillus plantarum* 299 v), **c)** Fermented beverage.

RESULTS

Table 1. Proximate analysis of the grain (g/100g).

Ecotype	Moisture	Protein	Ash	Fat	Carbohydrates	Energy (Kcal)
Altagracia	9.8 ±0.02	44.5±0.04	2.9±0.03	15.6±0.04	27.2±0.06	427.2±0.37

X±SD.
Energy calculated by Atwater factor.

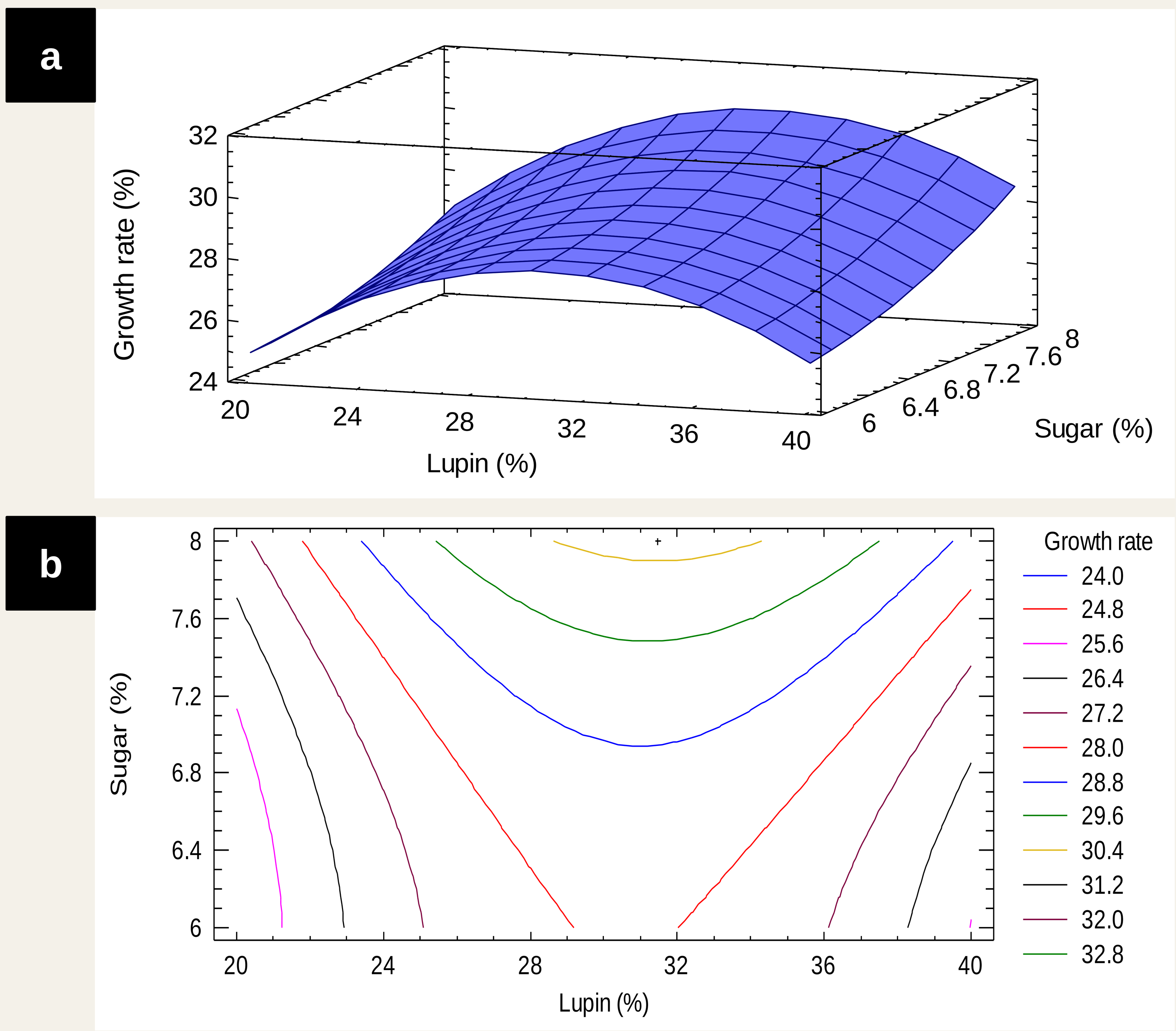

Fig.2. a) Response surface plots and **b)** Contour for the effects of Lupin/water ratio vs. sugar.

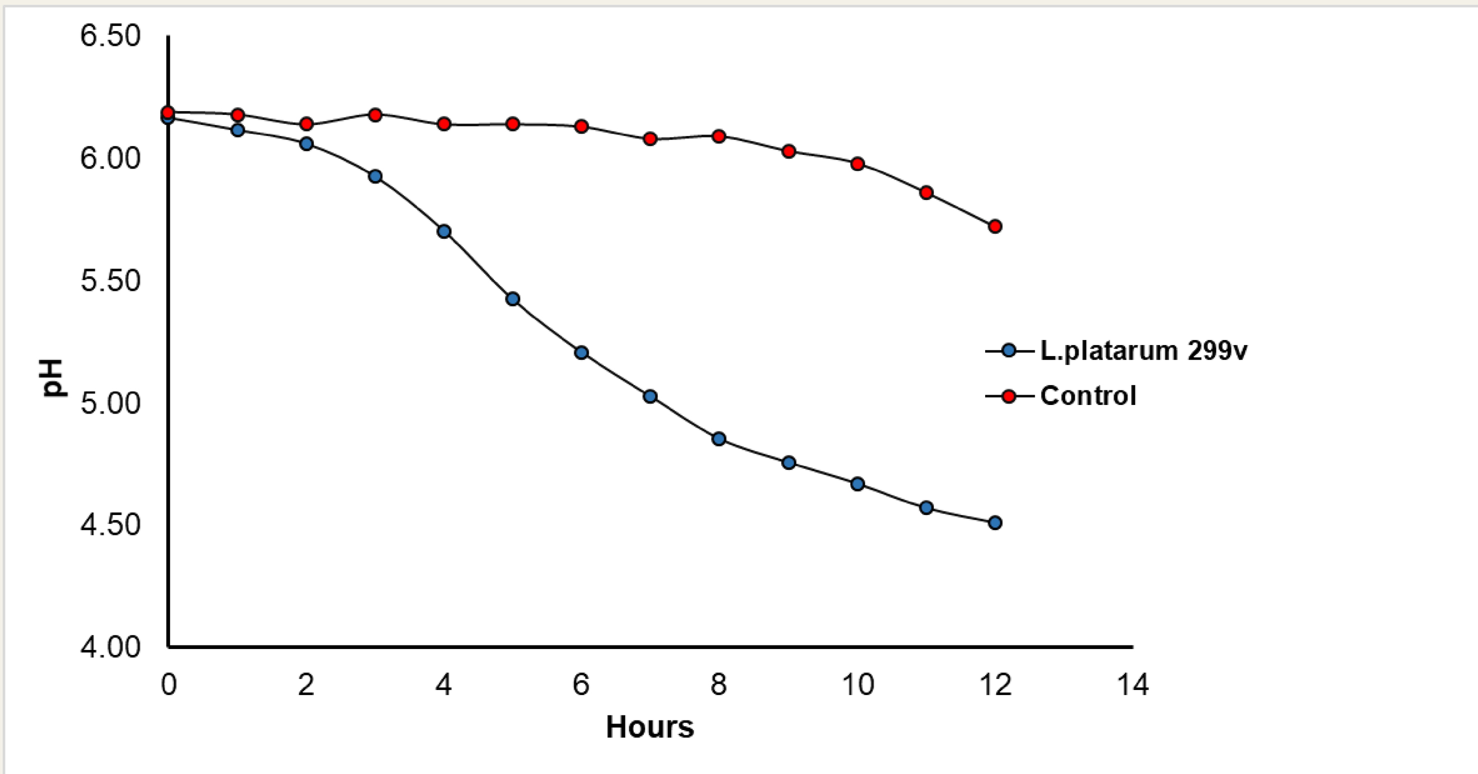

Fig.3. Kinetic of pH during the fermentation; Control (without *L. plantarum* 299v.)

CONCLUSION

The obtained response surface model (RSM) produced a correlation coefficient of approximately 0.80. Optimal growth was given to conditions of 8 g of sweetener and raw material/water ratio of 31/100(w/v) resulted in an exponential grow from 3.8 x 10 $^{-7}$ cfu ml^{-1} to 1.39 x 10^{-9} cfu ml^{-1}. This study shows that *Lactobacillus platarum* 299v can grow in a plant matrix, which was not affected by the presence of some secondary metabolites of *Lupinus mutabilis*, therefore the formulated beverage is suitable for lactic acid fermentation.

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