



## The Change in pH on *Lactobacillus acidophillus* Medium Containing D-fructose

Widia Pangestika<sup>1</sup>, Ahmad Ni'matullah Al-Baarri<sup>1,2\*</sup>, Anang Mohamad Legowo<sup>1</sup>

<sup>1</sup>Department of Food Technology, Faculty of Animal and Agricultural Sciences, Diponegoro University, Semarang

<sup>2</sup>Food Technology Laboratory, UPT Integrated Laboratory, Diponegoro University, Semarang

\*Corresponding author (albari@live.undip.ac.id)

### Abstract

This study aims to analyse the pH value on *Lactobacillus acidophilus* medium containing 3% (w/v) D-fructose. *L. acidophilus* was incubated at 37°C using MRS agar medium. Changes in pH values were measured for 48 hours. The non-sugar addition was also used as a comparison. Based on this research it could be seen that D-fructose slightly decreased pH in the medium at 48 hour incubation. This research might be useful to provide information on the potential use of D-fructose as a medium to maintain the reduction in pH.

Article information:

Received: 21 January 2018

Accepted: 30 May 2018

Available online: 30 May 2018

Keywords:

*Lactobacillus acidophilus*

pH

D-fructose

MRS medium

© 2018

Indonesian Food Technologists

All rights reserved

This is an open access article  
under the CC BY-NC-ND license

doi: 10.17728/jaft.4870

### Introduction

Member of *Lactobacillus* that is believed to have probiotic characteristics is *Lactobacillus acidophilus* and it contributes to provide health benefits for probiotics as well as provide the function as antimicrobial agents to avoid gastrointestinal infections, improvement in lactose metabolism, anti-mutagenic properties, anti-carcinogenic properties, reduction in serum cholesterol, anti-diarrheal properties and immune system stimulation (Shah, 2007). Based on research, fructose has been shown to double the growth of lactobacilli (Nutter *et al.*, 2017) due to its energy for growing. D-fructose was known as commercial sugar because of its unique physiological properties (Zhang *et al.*, 2016). This type of sugar may be affected the pH in the medium containing this lactic acid bacteria (LAB) (Moriya *et al.*, 2017).

This study aims to analyze the pH value on *L. acidophilus* medium containing D-fructose. The benefit of this study was to obtain information about changes in pH value after the addition of D-fructose.

### Materials and methods

Strains of *L. acidophilus* ATCC 4356 was obtained from Gadjah Mada University, Yogyakarta. D-

fructose was obtained from Kagawa Rare Sugar Research Center, Kagawa University, Japan and other ingredients were reagent grade.

### Medium for Bacterial Growth

*L. acidophilus* was inoculated in the MRS medium and this method was adopted from Moriya *et al.* (2017) with some modifications. One-time dilution using MRS Broth was applied in *L. acidophilus* and followed by incubation for 24 hours at 37°C. This step was done for two times.

### Production of D-fructose and D-allulose

Production of medium containing D-fructose was carried out using the methods of Yoshihara *et al.* (2016) with some modifications. D-fructose at 3% (w/w) was dissolved in 0,88% NaCl. This solution was filtered using 0.2 µm syringe filter. Obtained *L. acidophilus* was cultured in the MRS broth at ratio 1:9. This procedure was conducted two times in serial. The incubation time was 24 h in 37°C. The resulted culture was then applied in the medium containing D-fructose using similar previously ratio. The medium was incubated for 48 hours at 37°C and immediately prepared for pH analysis.

## Analysis of pH in Medium

Analysis of pH was carried out using the methods of Yoshihara *et al.* (2016) with the following procedure. 5 ml of D-fructose contained medium was tested for the pH using pH meter.

## Data Analysis

The data was calculated in the percentage of pH change using initial and final data.

## Results and Discussion

The result of pH measurement revealed that D-fructose decreased  $\pm 3\%$  pH of medium if compare to the those of medium with no D-fructose. The decrease in pH might explained *L. acidophilus* activity in producing organic acids during fermentation (Zubaidah *et al.*, 2012) and the production depended on temperature, medium, presence of salt, presence of preservatives, and growth inhibitors (Soliman *et al.*, 2015; Probst *et al.*, 2013; Vinderola *et al.*, 2002). Three percent of differences might be categorized as slight change because of the similarity of metabolism between D-fructose and other carbohydrates (Zhang *et al.*, 2016).

Glucose is known as supporting agent for the growth of lactic acid bacteria therefore, this study used MRS. As well known, MRS contains 3% glucose which was considered the same D-fructose treatment in this study. The reduction in pH of medium was a common phenomenon that occurs in lactic acid bacteria fermentation (Rhee *et al.*, 2011), however this decrease was lower than the decrease MRS medium only. This may be explained because of no competitive substrate used by *L. acidophilus* for growth (Khay *et al.*, 2014).

## Conclusion

During the 48 hour incubation process, the decrease in pH in *L. acidophilus* medium containing D-fructose could be determined as  $\pm 3\%$  reduction.

## Acknowledgement

The author would like to thank Kemenristekdikti for their support to conduct this research.

## References

- Charalampopoulos, D., Pandiella, S.S. Webb, C. 2002. Growth studies of potentially probiotic lactic acid bacteria in cereal-based substrates. *Journal of Applied Microbiology* 92(5):851–859. DOI: 10.1046/j.1365-2672.2002.01592.x.
- Khay, E., Castro, L., Bernárdez, P., Senhaji, N., Idaomar, M., Abrini, J. 2014. Growth of *Enterococcus durans* E204 producing bacteriocin-like substance in MRS Broth: description of the growth and quantification of the bacteriocin-like substance. *African Journal of Biotechnology* 11(3):659–665. DOI: 10.5897/AJB11.2945.
- Moriya, N., Hayakawa, S., Kuramasu, K., Ohmori, H., Yamasaki, S., Ogawa, M. 2017. Effects of rare sugar D-allulose on acid production and probiotic activities of dairy lactic acid bacteria. *Journal of Dairy Science*:1–9. DOI:10.3168/jds.2016-12214.
- Nutter, J., Fritz, R., Saiz, A.I., Iurlina, M.O. 2017. Effect of honey supplementation on sourdough: Lactic acid bacterial performance and gluten microstructure. *LWT-Food Science and Technology* 77:119–125. DOI: 10.1016/j.lwt.2016.11.040.
- Rhee, S. J., Lee, J.E., Lee, C.H. 2011. Importance of lactic acid bacteria in Asian fermented foods. *Microbial Cell Factories* 10 (SUPPL. 1). DOI: 10.1186/1475-2859-10-S1-S5.
- Shah, N.P. 2007. Functional cultures and health benefits. *International Dairy Journal* 17:1262–1277. DOI: 10.1016/j.idairyj.2007.01.014.
- Soliman, A. H. S., Sharoba, A.M., Bahlol, H.E.M., Soliman, A.S., Radi, O.M.M. 2015. Evaluation of *Lactobacillus acidophilus*, *Lactobacillus casei* and *Lactobacillus plantarum* for probiotic characteristics. *Middle East Journal of Applied Sciences* 5(1):10–18.
- Yoshihara, A., Kozakai, T., Shintani, T., Matsutani, R., Ohtani, K., Iida, T., Gullapalli, P.K. 2016. Purification and characterization of D-allulose 3-epimerase derived from *Arthrobacter globiformis* M30, a GRAS microorganism. *Journal of Bioscience and Bioengineering* 20(20): 1–7. DOI: 10.1016/j.jbiosc.2016.09.004.
- Zhang, W., Yu, S., Zhang, T., Jiang, B., Mu, W. 2016. Recent advances in D-allulose: physiological functionalities, applications, and biological production. *Trends in Food Science and Technology* 54:127–137. DOI: 10.1016/j.tifs.2016.06.004.
- Zubaidah, E., Nurcholis, M., Wulan, S.N., Kusuma, A.. 2012. Comparative study on synbiotic effect of fermented rice bran by probiotic lactic acid bacteria *Lactobacillus casei* and newly isolated *Lactobacillus plantarum* B2 in wistar rats. *APCBE Proceedia* 2: 170–177. DOI: 10.1016/j.apcbee.2012.06.031.