

PAPER • OPEN ACCESS

The effectiveness of lactic acid bacteria level on syneresis and acidity of fermented milk added carrot (*Daucus carrota* L) porridge

To cite this article: Yurliasni *et al* 2019 *IOP Conf. Ser.: Earth Environ. Sci.* **260** 012086

View the [article online](#) for updates and enhancements.

The effectiveness of lactic acid bacteria level on syneresis and acidity of fermented milk added carrot (*Daucus carrota* L) porridge

Yurliasni*, Z Hanum and R Jannah

Department of Animal Husbandry, Faculty of Agriculture, Universitas Syiah Kuala, Banda Aceh, Indonesia

E-mail: [*yurliasni62@gmail.com](mailto:yurliasni62@gmail.com)

Abstract. This experiment aimed to evaluate syneresis and acidity of fermented milk which is combined with varying levels of carrot porridge and lactic acid bacteria (LAB). There were 2 types of LAB used *Lactobacillus acidophilus* and *Lactobacillus casei*. The experiment carried out using a completely randomized design (CRD) of factorial patterns which is consisting of two factors. Factors were A: 2.5% and 5% level of starter LAB and B: three levels of carrot porridge (5, 10 and 15%). Variables measured were acidity (pH) and degree of syneresis. Data were analysed using analysis of variance (ANOVA) and the differences between treatment means were examined by Duncan Range Test (DMRT). The results showed that the pH very significantly ($P < 0.01$) affected by LAB and carrot porridge level but syneresis significantly ($P < 0.05$) effected only by level of carrot porridge. In conclusion that the best pH and syneresis resulting in 2.5 and 5% of starter at 5% carrot porridge level.

1. Introduction

The utilization of lactic acid bacteria (LAB) in fermented milk is now very wide and well known, especially those are probiotics such as *Lactobacillus acidophilus* and *Lactobacillus casei*. Probiotics have been define as selected viable microorganisms used as dietary supplement having potential for improving health following ingestion. Probiotics also known as friendly bacteria that has capability of enhancing our nutritional status and have specific and important therapeutic role such as reducing lactose intolerant, inhibiting the growth of pathogenic bacteria in the gut and preventing indigestion, protection against gastrointestinal infection, having anticarcinogenic effect, lowering of serum cholesterol and alleviating of constipation [1, 2]. Fermented milk products are often found in the market generally in fruit-flavoured and has not been found with vegeTable flavour. Based on this situation, it is necessary to improve the product by adding or supplementing the taste of vegeTables into it. Carrots have good nutrition and contain several active compounds such as protein, vitamins, minerals fibre and antioxidant. It is expected that the addition of carrot porridge in fermented milk is able to improve nutritional value, flavour and consumers preference and also make it as a functional food.

Syneresis and acidity affect the quality of fermented milk, because the properties can be us as the quality indicators. Syneresis is mostly affected by the low total solids and high in acidity level. Carrots are rich in active compounds content, therefore to produce a good product it is necessary to evaluate



the syneresis and acidity of fermented milk added with carrot porridge. It is expected that all changes that occur during the fermentation process will be acceptable.

2. Materials and methods

The study was held in Milk Science and Technology Laboratory, Department of Animal Husbandry, Faculty of Agriculture, Universitas Syiah Kuala, Banda Aceh. Dairy sources used in the study were from Aceh Lives Stock farm, LAB such as *Lactobacillus acidophilus* and *Lactobacillus casei* as culture starter obtained from Microbiology Laboratory of Food Science, Bogor Agricultural Institute and carrot originated from community market in Banda Aceh. Fresh milk was pasteurized at 85 to 90 °C for 10 minutes, then cooled to 30°C. Carrots (*Daucus carota* L) was peeled, washed, diced, mashed, filtered and pasteurized at 85 to 90°C for 5 minutes, resulting in carrot porridge. Pasteurized milk was poured into 24 bottles of 100 mL each, then a starter and carrot porridge are added as designed, incubated at 37°C for 13 h. This experiment used a complete randomized design of factorial pattern consisting of 2 factors, 2.5% and 5% level of starter and carrot porridge level (5, 10 and 15%) and it was repeated four times. Parameters observed are pH and syneresis. The data were analysed using Analysis of Variance (ANOVA). Duncan test was conducted as a further test to identify statistically significant differences in the experiment ($\alpha = 0.05$ and 0.01) [3].

pH analysing using pH meter (ToA), previously pH meter was calibrated with buffer solution (pH 6.8 and pH 4.0), then as much as 10 ml of sample in test tube is measured with electrode and the result can be read on the monitor of pH meter [4].

Method for Syneresis, 10 g of sample was weighed in a centrifuge tube, then cooled at 5°C, centrifuged for 10 m at a speed of 300 rpm, weigh the supernatant. Syneresis value is weight of the supernatant divided by sample weight multiplied by 100% [5].

3. Results and discussions

The addition of carrot porridge and LAB at different levels in fermented milk affect the pH values between treatments. The average of pH ranging between 3.46 to 3.71. However, the resulting pH was lower than the pH of regular yogurt (pH 4.5 to 4.6). It is very obvious that the application of 2.5% of LAB at all carrot porridge levels increase the pH. Fleet (1990) [6] stated that LAB such as (*Lactobacillus acidophilus* and *Lactobacillus casei*), produce lactic acid as main product from carbohydrate fermentation which is able to decrease the pH of fermented milk. Based on the Duncan test showed that the lowest pH was found in fermented milk using 2.5% starter and 5% carrot porridge and was significantly different with 5% starter at 10% carrot porridge as the highest pH (3.57), while there is no difference between the remaining treatments.

Table 1. The Average of pH value of fermented milk Added LAB and carrot porridge at different level

| Treatment | pH |
|-------------------------------|-------------------|
| A ₁ B ₁ | 3.46 ^c |
| A ₁ B ₂ | 3.54 ^b |
| A ₁ B ₃ | 3.58 ^b |
| A ₂ B ₁ | 3.61 ^b |
| A ₂ B ₂ | 3.71 ^a |
| A ₂ B ₃ | 3.57 ^b |

Note: Means in the same column with different superscript differ significantly at (P<0.01)

A₁: 2.5%; A₂: 5% (starter level); B₁: 5%; B₂: 10%; B₃: 15 % (porridge level)

In accordance to [7] that the standard pH of yogurt ranging between 3.5-4.5. The decrease of pH is due to the LAB utilized lactose as a source of energy to produce lactic acid resulted in the decrease of fermented milk pH [8].

The change in pH value (Table 1) indicated that the addition of all carrot porridge levels at 2.5% of LAB resulting in lower ability to convert lactose and other sugars into lactic acid, while at 5% of LAB the ability is lower up to 10% of carrot porridge but higher at 15 % carrot porridge and as a consequence the pH is decrease. LAB activity in this case (*L. acidophilus* and *L. casei*) is also affected by the nutrients contained in carrot porridge. An adequate supply of nutrients will support the growth of LAB [9].

A combination of starter and carrot porridge significantly ($P < 0.05$) affects the syneresis of fermented milk as shown in Table 2. Based on Duncan's Multiple Range test, there is a difference between 15% of LAB at 5 and 10% of carrot porridge level. Based on data above it is obvious that the addition of carrot porridge significantly ($P < 0.05$) affect on syneresis values. The addition 15% of carrot porridge is significantly increase the syneresis of fermented milk. The syneresis change occur due to the lack of total solid in fermented milk added carrot porridge. The high content of carrots porridge causes a lot of free water content available so that it will increase the syneresis value and finally lower the quality of fermented milk.

Table 2. The Average of syneresis value of fermented milk added LAB and carrot porridge at different level

| Treatment | Syneresis (%) |
|----------------|--------------------|
| B ₁ | 44.68 ^b |
| B ₂ | 45.66 ^b |
| B ₃ | 51.06 ^a |

Note: Means in the same column with different superscript differ significantly at ($P < 0.01$)

B₁: 5%; B₂: 10%; B₃: 15% (level of porridge)

As shown in Table 2, the addition of 15% carrot porridge at all level of LAB decrease of fermented milk quality and turn in to unsTable consistency of fermented milk, indicated by higher value of syneresis which is 51%. In a similar study conducted by [10] stated that the occurrence of syneresis is due to the low ability of proteins to bind water. Other research of [11] also mentioned that syneresis can cause changes in solubility and shrinkage of the casein particles. In other similar studies carried by [5] also found that syneresis take place due to agitation which weakens the hydrogen bonds among proteins and water molecules in an acidic environment, as the effect of exposure to pores of protein molecules can be passed by water molecules. Syneresis can be also caused by acidity (pH), water holding capacity of fermented milk and also influenced by raw materials and additives composition [12-13]

4. Conclusion

The addition 2.5 and 5% of starter at 5 and 10% of carrots porridge produce the best product which has the pH that meets of Indonesian National Standard (INS), 2000 and lower degree of syneresis.

References

- [1] Chatow L N D D O and Trenev N 1999 *Probiotics: The Levotionari Friendly Bacteria Way to Vital Health and Well-Being* (Wellingborough: Thorsons Publishing)
- [2] Panesar P S, Kaur G, Panesar R D and Bera B 2009 *Symbiotic: Potential Dietary Supplements in Functional Foods* (FST Bulletin Food Science) (UK: Central IFIS Publishing)
- [3] Steel R G D and Torrie J H 1995 *Principles and Procedures of Statistics: A Biometrical Approach* (Jakarta: PT Gramedia Pustaka Utama)
- [4] Hadiwiyoto S 1994 *Teori dan Prosedur Pengujian Susu dan Hasil Olahannya (Theory and Procedure of Testing of Milk and Processed Products)* (Yogyakarta: Liberty)
- [5] Harwalkar V R and Kalab 1983 Suceptibility of Yogurt to Syneresis Comparison of Centrifugation and Drainage Methods **38** pp 517-21
- [6] Fleet G H 1992 Spoilage Yeast *Crit Rev Biotechnol* **12** pp 1-44

- [7] James 2005 *Modern Food Microbiology* (New York: Cahoman and Hall Book)
- [8] Kumalasari K E D, Nurwantoro dan Mulyani S 2012 Pengaruh kombinasi susu dengan air kelapa terhadap total bakteri asam laktat (BAL), total gula dan keasaman drink yogurt. (The effect of milk and coconut water combination on total of lactic acid bacteria (LAB), total sugar and acidity of yogurt drinks) *Jurnal Aplikasi Teknologi Pangan* **1** pp 48-53
- [9] Murpi E N 2008 *Kajian Sifat Fisik Yogurt Pasteurisasi dan Tanpa Pasteurisasi pada Penyimpanan Lemari Es (Study of Physical Properties of Pasteurized and Unpasteurization Yogurt in Refrigerator Storage)* (Makassar: Fapet UNHAS)
- [10] Setiadi 2007 Aktivitas proteolitik *Lactobacillus acidophilus* dalam fermentasi susu sapi (Proteolytic activity of *Lactobacillus acidophilus* in fermented cow milk) *Jurnal Ilmu Peternakan* **7** pp 69-72
- [11] Manab A 2008 Kajian sifat fisik yogurt selama penyimpanan pada suhu 4°C (Study of the physical properties of yogurt during storage at 4°C) *Jurnal Ilmu dan Teknologi Hasil Ternak* pp 52-8
- [12] Sawitri M E, Manab A and Palupi T W L 2008 Kajian penambahan gelatin terhadap keasaman, pH, daya ikat air dan sineresis yogurt (Study of the addition of gelatin on acidity, pH, water bonding and yogurt syneresis) *Jurnal Ilmu dan Teknologi hasil Ternak* pp 35-42
- [13] Wardhani D H, Diana C M and Eko A P 2015 Kajian pengaruh cara pembuatan susu jagung, rasio dan waktu fermentasi terhadap karakteristik yogurt jagung (Study the effect of corn milk processing, ratio and time of fermentation on the characteristics of corn yogurt) *Jurnal Momentum* **11** pp 7-12

Acknowledgement

The author would like to thank LITPS laboratory of Universitas Syiah Kuala which have facilitated this research and also to thank to Yusdar Zakaria and Ria Febrianti which always help to carry out this research.