# Optimizing Dehydration Conditions of Cow's and Goat Milk Yogurt Powder

**Ibrahim Aldaw Ibrahim, Rifda Naufalin, Erminawati, Hidayah Dwiyanti**

***Abstract:*** ***Yogurt is one the importance the most common fermented dairy products widely consumed worldwide, mmostly studies are about in how to longer the yogurt shelf life, this study purposed to drying cow and goat milk yogurt by freeze dryer to provide alternative method don't have effect on yogurt compounds and lactic acid bacteria cell, and to identification the influence of stirring and time on yogurt powder compounds, the International Official Analytical Chemistry Association (AOAC) and the Indonesian National Standard (SNI) methods were used to analyze the chemical composition of yogurt powder, Cow's and goat milks were mixed in rate 25:75 (v/v), inoculum with culture 15% (v/v) S. therophillus, L. acidophilus, L. burgaricus (1:1:1), and incubated at 46$^{o}$C for 8h.Yogurt was dryed by freeze dryer at -73$^{o}$C for 16, 19, and 22hours on 4, 5, and 3 batches with stirring respectively, The results obtained from this study that the best drying method of cow and goat yogurt treated by freeze dryer was19h., drying by freeze at batches with stirring have no significant effect on amount of bacteria cells, moreover, it is an excellent method to preserve the desirable microbiological properties in yogurt, and decreased the drying time and improving quality of final product.***

***Keywords: Yogurt, Dehydration, Nutritional value***

## I. INTRODUCTION

Yogurt is one the importance the most common fermented dairy widely consumed worldwide. Yogurt from cow's milk is widely consumed all over the world. Moreover, there is a great demand for alternative to cow's milk due to allergy-related problems, gastrointestinal disorders and the desire for new dairy products (Weerathilake et al, 2014), (Shu et al, 2015).

Goat milk have a higher digestibility and less sensitivity digestion than cow's milk, in addition highest content of short-chain fatty acids in milk fat, high iron and zinc content magnesium and antibacterial characteristics, additionally, these benefit can be further enhanced by using goat's milk as a method of providing probiotics (Slacanac et al., 2010), (Kumar et al., 2012e), (Zenebe et al., 2014). Goat's milk is the third largest dairy supplier after cow's milk and buffalo milk, which has multiple functions in nutrition, health and diet. Gradually became the product of choice for high-end consumers. In general, there is no insignificant difference in the nutritional value of goat's and cow's milk. Due to its nutritional properties and better metabolism, goat milk has been proposed as an ideal alternative for allergy and infant patients based on cow's milk and other food sources (Guowei et al., 2016), (Haenlein and Anke, 2011).

Yoghurt powder is dehydrated products producing by one of drying methods based on removal water or reduces water activity of finally

product. Which increase the shelf life of food. Yogurt powder can be prepared in various methods, the most use such as spray-drying, freeze-drying. Freeze dried yogurt has capable to keep its nutritional values for up to two years with storage it at 4$^{o}$C. Yogurt powder has many applications in making instant yogurt powder and in food industries such as Bakery, confectionary and healthy drinks (Kumar and Mishra, 2004), (Balkir, 2011), (Krasaekoopt and Bhatia, 2012).

Freeze drying and freeze concentration has capacity of reduce water activity of foods a with keep nutritional and sensory qualities (Khalisanni, 2011), (Aalaei et al., 2016). For obtain longer shelf life and good quality of product, the yoghurt powder can be stored at low temperatures and dry condition (Chutrtong, 2015), (Abbas et al., 2014). The Thermal stability studies that both processes of freeze-drying and spray-drying not has influence in behaviours of whey protein (Vincenzetti et al., 2018). This study purposed to drying cow and goat milk yogurt by freeze dryer to provide alternative method don't have effect on yogurt compounds, viable cells of lactic acid bacteria lactic, and to determine the effect of time with stirring on yogurt powder compounds.

## II. MATERIAL AND METHOD

### A. Preparation milk and yogurt samples

The cultures of *S. thermophillus, L. acidophilus and L. bulgaricus* obtained from livestock technology Laboratory faculty of animal hasbandury, Universitas Jendural Soedirman. In order to preparing milk samples, they were treated cow and goat milks at 85$^{o}$C for 5sec and cooled to 45$^{o}$C, then cow and goat milks was mixed 25:75 (v/v), incoulated with culture (inoculum size 15% (v/v)), then were fermented at temperature 46$^{o}$C for 8hr. the yogurt samples storage at 4$^{o}$C to 12hr. After that yogurt samples preparing to dry by freeze dryer.

### B. Dehydration process

All Yogurt samples were separated to three groups, and coded A, B and C. Then put in small topless 24/liter, and were freeze at -81$^{o}$C before processing. Yogurt samples were dehydrated by freeze dryer (Virtis, model bench top 2kxc) at -72$^{o}$C for three times 16, 19,

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and 22hr with stirring 4, 5, 3 times respectively.

### C. Determination proximate and microbiological parameters

The proximate analysis of yogurt powder was determined according to the procedures recommended by the International Official Analytical Chemistry Association AOAC, (2005), and the Indonesian National Standard SNI, (2011). Total lactic acid bacteria were analyzed according to methods of Pestana et al., (2015), as described by Ehirim and Onyeneke (2013).

### D. Sensory evaluation

The panel test was measured according to the 9 point hedonic scale, and was used to illustrate team members (20 participants from Food Science and Technology Students), acceptance of taste, smell, texture, color, and overall acceptability.
According to the methods of (Santos et al., 2018).

### E. Statistical Analysis

The analysis of variance (ANOVA) tests were performed to evaluate the difference between data by using Microsoft Excel version (2013). The means were separated by Duncan multiple range test. Significant differences were determined at (P≥0.05).

## III. RESSULTS AND DISCUSSION

### A. Yogurt powder recovery rate

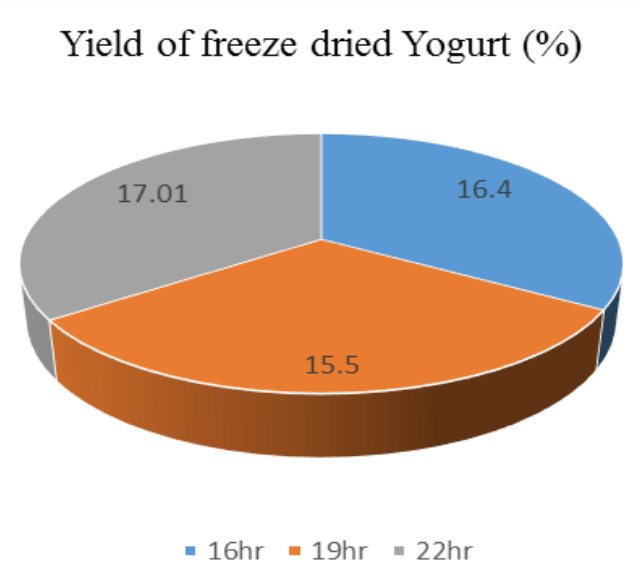


**Figure1. Yogurt powder recovery rate**

Figure1. Showed the results of powder yogurt yield of freeze dried yogurt. The dehydration ratio of cow and goat milk yogurt powder was dryer at 16, 19, 22 hours, were 16.4, 15.5, and 17.01% respectively. The dehydration ratio of cow and goat yogurt for 22h is higher yields compare with other treatments. And dehydration ratio of yogurt samples treated at 19h is lowest to compare with 16, 22h. These different may due to conditions of dehydration, capacity used for dehydration and water content in final yogurt powder. Moreover, this different due to amount of stirring during dehydration and count of batches during drying yogurt samples, sample A stirring 4 times, B stirring 5 times, and C stirring 3times. This result comparable with Santos et al., (2018), who found the yield of freeze dried yogurt was 18%.

### B. Composition of cow and goat yogurt powder

The composition results of yogurt powder samples were shown in Table1. The protein content of cow and goat yogurt powder were 17.11, 20.07, and 16.54 respectively. There were significant difference (P≥0.05) between cow and goat yogurt powder. The result shown the time had significant influence on protein content of powder yogurt. This result is incomparable with Sulaksono et al., (2013) who mentioned that the protein content of yogurt powder treated by spray dryer was 31.2%, and Krasaekoopt and Bhatia, (2012), they reported that the protein content f freeze dried yogurt was ranging 33.0 – 36.0%. These difference in protein content due to destruction protein in yogurt as well as the destruction of hydrogen bonds and non-polar hydrophobic reaction. Then lead damage the molecule bond and milk protein denaturation and coagulation occurred during the drying process (Damasceno et al., 2008).

Table1. Chemical composition of cow and goat yogurt powder

| Samples | Protein | Fat | Ash | Moisture | Carbohydrate |
|---|---|---|---|---|---|
| A | $17.11^{b}$ | $30.14^{b}$ | $0.23^{b}$ | $18.49^{b}$ | $33.96^{b}$ |
| B | $20.07^{a}$ | $36.03^{a}$ | $0.12^{c}$ | $7.00^{c}$ | $36.67^{a}$ |
| C | $16.54^{c}$ | $28.46^{c}$ | $0.89^{a}$ | $20.87^{a}$ | $33.18^{c}$ |

A = Dehydration for 16hr, B = Dehydration for 19hr, C = Dehydration for 22hr

Heat treatment affects in the molecular structure of milk protein at the surface of oil-in water emulsions in water and in the aqueous medium (Raikos, 2010), (Paskov et al). The fat result of cow and goat yogurt powder were 30.14, 36.03, and 28.46%, respectively. The result shown in table2 reveals that the fat content of yogurt powder were remarkably affected by time and stirring applied to it. However, fat content of group treated by 22hr with three times stirring were significantly (P≤ 0.05) higher followed by (16hr with four times stirring) and (19hr with five times stirring). Moreover, the fat content in sample B was remarkably higher (P≤ 0.05) than that of A and C yogurt powder. This results showed the time and stirring had significant effect on increased fat content in yogurt powder. This result is no similar with Krasaekoopt and Bhatia, (2012), they reported that the protein content f freeze dried yogurt was ranging 1.2.0 - 2.0%, and comparable with Sulaksono et al., (2013) who noted the fat content of powder of yogurt treated by spray dryer was 36.2%. This different in fat content due to oxidation in fat by drying processing. The moisture content of powder yogurt were 18.49, 7.00, and 20.87% respectively. Form this result there were significant difference (P≥0.05) between each powder yogurt samples. The results show that time and stirring had significant effect on moisture content of yogurt powder production, but it varied with period time used in this research. The moisture was in a range of 7.00 – 20.87%. these results is compatible to the value reported by Sulaksono et al., (2013) they found the moisture content of powder yogurt was 10.3%,

and Krasaekopt and Bhatia, (2012) they mentioned that the moisture content of powder yogurt was ranged between 8.5 – 8.6%. These results shown the greater the count of stirring and at batches during not continuous drying could lead drying process faster. The results in ash content of yogurt powder were 0.23, 0.12, and 0.89% respectively. The result obtained in this study reveals that the fat content of yogurt powder were remarkably affected by time and stirring applied to it. However, fat content of group treated by 19hr with three five stirring were significantly (P≤ 0.05) higher followed by (16hr with four times stirring) and (22hr with three times stirring). Moreover, the fat content in sample C was remarkably higher (P≤ 0.05) than that of A and B yogurt powder. This result showed the time and stirring had significant effect on Decreased fat content in yogurt powder. This result is no similar with Krasaekoopt and Bhatia, (2012), they reported that the protein content f freeze dried yogurt was ranging 7.0 - 8.0%, Sulaksono et al., (2013) who noted that the fat content of yogurt powder treated by spray dryer was 6.7%.

## C. Microbiological characteristics

The bacteria counts of the yogurt powder samples shown in Figure2. The results of total lactic acid bacteria of yogurt powder were 5.9, 5.7, and $5.7\times10^6$ cfu/g respectively. This results showed there were no significant effect on viable cells of lactic acid bacteria in all samples of yogurt powder. These results similar with Santos et al., (2018) who reported the freeze-drying can preserving the microbiology, nutritional value and sensory properties of yogurt, Krasaekoopt and Bhatia, (2012), they recommended that the viable bacteria cells in freeze dried yogurt was 5.6 x $10^7$ cfu/g, and incomparable with Sulaksono et al., (2013) who reported the viable bacteria cells in freeze dried yogurt was 12 x $10^7$ cfu/g. According to the Identity and Quality Standards of fermented milk – MARA minimum counts of $10^7$CFU/g viable bacteria cells as required in the yogurt until its consumption. In line with these requirements, the bacteria counts of cow and goat yogurt powder (Fig1) were similar with required by legislation for fermented milk. Therefore, the freeze-drying is an excellent method for drying yogurt.

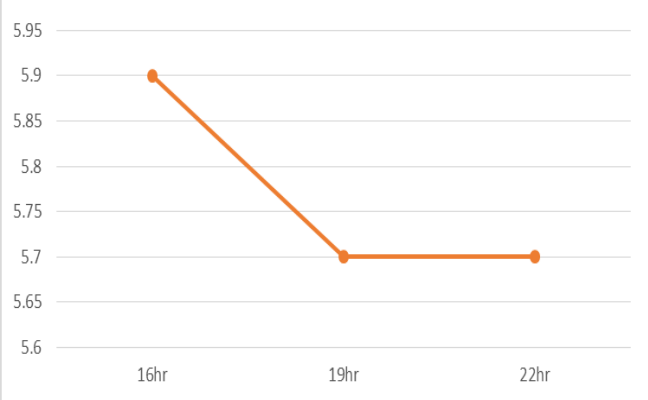


**Figure2. Effect of dehydration time and stirring on viable bacteria cells ($10^6$ cfu/g)**

## D. Organoleptic test

**Table2. Sensory test of freeze cow and goat yogurt powder**

| Samples | Color | Texture | Aroma | Taste | Overall Acceptability |
|---|---|---|---|---|---|
| A | 7.17 | 7 | 6.7 | 6.88 | 7.7 |
| B | 7.64 | 7.7 | 7.23 | 7.35 | 7.76 |
| C | 7.11 | 6.29 | 6.94 | 7 | 7.76 |

A = Dehydration for 16hr, B = Dehydration for 19hr, C = Dehydration for 22hr

The sensory profiles of cow and goat yogurt powder shown in Table2. The color of cow and goat yogurt powder treated at 16, 19, and 22 hours with stirring were white to white yellowish. The aroma of yogurt powder produced at 16, and 19 with four and five times stirring was better accepted than yogurt powder produced at 22hr with three times stirring. The taste of yogurt powder obtained was better in yogurt powder produced at 16, and 19hr than 22hr. The overall acceptability of yogurt powder produced at 19hr with five stirring was liked very much.

## IV. CONCLUSION

This present study established that the not continuous drying (batches) with stirring during dehydration yogurt has significant effect on increasing protein and fat content, and decreasing ash and moisture content in final product. Moreover, drying yogurt by freeze dryer at -73$^o$C for 19hr with batches and stirring up to 5times is better. However, it is suitable method for drying yogurt, which is decreased the drying time and improving the Quality of final product.

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