Development of *dadih* powder as a complementary food to prevent children from stunting in West Sumatra, Indonesia

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**Abstract.** This research aims to produce pasteurized *dadih* powder and the best condition for its production for the formula of supplementation. Besides, it is aimed at developing formula complementary food, and it is used as local food to prevent children from stunting. The characteristics of *dadih* were analyzed by biochemical and daily intake converted into percentages. *Dadih* powder was analyzed with proximate and the total of lactic acid bacteria. The nutritional composition formula is analyzed by using Nutrisurvey Programme. Based on the result, it is recommended that the *dadih* powder should be given daily to the children at the age of 6-8 months. Furthermore, about 126 children were measured by using “anthropometric evaluation” to find out whether the children belonged to stunting. The electronic scale was used to know the bodyweight of the children, and the recumbent length was taken by using length board. Each piece of equipment has a precise standard in which 0.1 kg is matching to 0.1 cm. The calorie in 100 g of *dadih* consists of 95.51 kcal with 31.8 g protein, 34.11 g fat, and 29.6 g carbohydrate. The formula of complementary food was recommended at daily intake for children under two years of age based on their need: energy of 200 to 250 kcal and 6 to 8 grams of protein. *Dadih* powder was obtained by freezing technology and the use of vacuum heating to stabilize the powder. The nutritional composition of the *dadih* powder was standardized according to nutrition recommended to children under two years. Based on the anthropometric measurement of the nutritional status of children, there were 15.9 % stunting, 10.3 % underweight, and 3.2 % wasting.

**Keywords:** yoghurt, supplement, food

1. **Introduction**

*Dadih* an Indonesian traditional fermented buffalo milk which is produced and consumed by the ethnic group of West Sumatera. It is a characteristic traditional food of the Minangkabau culture. It has a thick consistency and slightly sour taste. Lactose buffalo milk is fermented by bacteria to produce lactic acid. It is thickened with casein, then turned it into a yoghurt-like or white like tofu. The serving of *dadih* in a bamboo tube usually makes it smelly [1,2].

*Dadih* is categorized into functional food because of its nutritional content, which provides benefits for human health. The functional value of *dadih* is lactic acid obtained from a bacterial known as...
probiotics[3]. Lactobacillus sp. is the probiotics of dadih with high lactic acid production. The result of some research suggests that probiotics can survive in the human digestive tract. Health benefits are gained when consuming probiotics regularly in an amount of $10^6$-$10^7$cfu/ml.

The main benefits of consuming probiotic of dadih include to increase of immunity due to intestinal infections, to improve lactose digestion, mineral absorption, vitamin synthesis, and protein digestion. Inadequate nutritional intake and infectious diseases can cause stunting[4]. The quality and quantity of protein and micronutrients consumed, such as zinc, calcium, phosphorus, iron, are vital to infants and children. The effectiveness of these nutrients will lead to a healthy digestive tract. Therefore, dadih can be used as an alternative food supplement for infants[5].

Later on, Minangkabau people think of how to preserve nutrition in dadih longer than usual, so it stays fresh for a certain period, easy to send it widely, and easy to transport it as well. The idea comes to transform dadih into dadih powder. The process is carried out to preserve nutrition, storage, and transportation. So, the dadih powder can be used for both health purposes and commercialization. However, transforming dadih into dadih powder has not been developed yet. Based on this fact, it is necessary to transform dadih into a dadih powder that can be applied to the food supplement formula. Therefore, this research aims to produce pasteurizing dadih powder and the best condition for its production for formula supplementation.

2. Materials and Method
This research was conducted in two steps, namely 1) to determine the characteristics of dadih and 2) to transform dadih into dadih powder.

The production of dadih powder is aimed at characterizing the nutritional compound and its stability. Dadih powder can enrich infant food supplements to achieve probiotic daily intake. The raw material in the form of dadih spontaneously fermented after 48 hours. The dadih was derived from the farm of Agam district. The transformation technique used is the freezing method to sustain probiotic. A perfect dry dadih got with spread temperature to all dadih’s components. Dadih was flattened 1cm thickness in plates and was frozen at -20°C for two days. The top surface of dadih looks cracked and white colors. The frozen dadih was stabilized by using a vacuum oven heating at a temperature of 40-50°C for 5-10 minutes until the obtention of moisture content of 5% based on milk powder quality.
standard (SNI 2970: 2015). Moisture content was transformational analyzed by the gravimetry method with a dry oven[6]. The concentration of 5% got after frozen dadih heating in a vacuum oven for 10 minutes at 50°C.

Characteristics of dadih Powder was analyzed with proximate and the total of lactic acid bacteria. Enterococcus faecium and Lactobacillus plantarum were lactic acid bacteria from dadih. Water content was analyzed by the thermogravimetric method, and protein content was processed by Kjeldahl method, Soxhlet extraction of fat content, dry-ashing method of ash content. Total lactic acid bacteria were calculated based on the total plate numbers by using de Man, Rogosa, and Sharpe (MRS) agar medium.

The last step was counting the percentage of daily intake. The determination of calorie was calculated by using 4:4:9 kcal/g conversion, then counted by using Nutrisurvey 2007 software based on protein, carbohydrate, and a fat component.

3. Result and Discussion

At the initial stage, the anthropometric measurement was carried out in 126 children who were followed up from birth, whose pregnant mothers had been given dadih since the second trimester for six-month intervention from the study before [7]. The children were followed up at the age of 6 to 8 months to obtain data on their nutritional status and prevalence of stunting, as shown in Table 1.

| No | Nutritional Status                                      | N  | %   |
|----|--------------------------------------------------------|----|-----|
| 1. | Underweight (Weight for age Z- Score WHO Anthropometrics) | 13 | 10.3|
| 2. | Stunting (Height for age Z-Score WHO Anthropometrics)   | 20 | 15.9|
| 3. | Wasting (Weight for Height Z- Score WHO Anthropometrics) | 4  | 3.2 |

Table 1 shows that the nutritional status of children in the followed-up period includes stunting 15.9 %, underweight 10.3 %, and wasting 3.2 %. This prevalence of stunting is lower than the data from the Basic Health Research Ministry of Health in West Sumatera Province, namely about 27.9 % of prevalence stunting in children under two years [7]. Growth and development of the two years old children that show rapidly will need high nutrition. In this period, they need interventions to prevent growth failure and to increase optimal development[8]. Further intervention for stunting children crucially needs optimal nutrition, as found in dadih.

Dadih analyzed in this study is dadih obtained from a buffalo farm in Agam District, West Sumatera Province, Indonesia. Buffalo milk production is more popular that of cow milk. The nutrition of calcium and protein from buffalo milk is higher that of cow milk. Besides, the protein on buffalo milk is more resistant to heat treatment [9]. This is in line with the research that buffalo milk has high-calorie value, and it is used as raw material for dairy as well [10]. The amount of calorie obtained in this study is 95.51 kcal, while the chemical characteristics of dadih include: total solid: 19.56 percent, protein: 7.95 percent, fat: 3.79 percent, and carbohydrate: 7.40 percent. This compound is lower that of our previous research, which showed that dadih from the Agam district has 237.68 kcal [5].

The protein content of dadih in this study is higher than that of buffalo milk, which is estimated at 4.49% [11]. The total solid of buffalo milk dadih was 13.66 percent, with 3.6 % of fat content, 4.01 percent of protein content, and 5.09 percent of carbohydrate content [12]. The higher the nutrient contents in dadih, the better the consistency of dadih in the formation of texture and the increase of softness of dadih. Dadih has a white tofu-texture and a yogurt like-smell. Soft and smooth dadih texture increases consumer preference compared to fresh milk [13].

The total solid of dadih can be increased by activating peroxidase enzymes that are found in fresh milk [12]. Peroxidase enzyme provides an antimicrobial effect to inhibit lactic acid bacteria converting lactose into lactic acid during the fermentation process. The dadih used in this study is derived from...
fresh buffalo milk fermented in a bamboo. This process causes low peroxidase concentration and high total solid content. The fermentation of dadih occurs naturally due to the content of lactic acid bacteria in bamboo. The total lactic acid bacteria found in the final product was $4.6 \times 10^6$ CFU/ml. *Enterococcus faecium* and *Lactobacillus plantarum* are two strains of lactic acid bacteria from dadih, and they are potential probiotic [14,15].

In this study, dadih powder was processed by using a temperature of -20ºC for 40 hours. Dadih evaporates as water decreases during freezing for 8-10 hours. Continued freezing for the second 8-10 hours will result in the decrease of bound water from dadih. Whereas to produce dry dadih noted that it takes 10-18 hours [3]. The amount of calorie dadih powder obtained was 91.6 kcal, while the nutritional value of dadih powder is shown in Table 2.

| No | Nutrient Contents | Nutrition (g) |
|----|-------------------|---------------|
| 1  | Protein           | 6.2           |
| 2  | Fat               | 6.8           |
| 3  | Carbohydrate      | 1.4           |
| 4  | Calory            | 91.6          |

The next stage is to heat the vacuum to prevent dadih powder from syneresis. The temperature was used proportionally to maintain the stability of glucose and galactose contents. The lower temperature of 35ºC results in lower glucose and galactose[3]. This is in line with the aim of the drying process, in which the temperature of 42-46ºC was used [16].

Dadih powder is useful in maintaining probiotic, reducing water activity (Aw), and reducing transportation costs. Bacillus groups were more resistant in process, although probiotic decreases each three logarithmic if stored for 30 days [16]. The process of dadih powder by using the freezing method can reduce the viability of *S.thermophilus* from $10^9$ CFU/ml to $10^7$ CFU/ml while *L. bulgaricus* from $10^6$ CFU/ml to $10^4$ CFU/ml [17].

The general physical characteristics of dadih powder are shown in Figure 2. Dadih powder is white, while the yellowish color because of heating the temperature of 40ºC. Dadih powder contains protein and lactose as sugar as the chemical reaction between protein and lactose, which is introduced by the Maillard reaction. The texture of dadih powder is rather rough, while sieving was produced to soften the texture of the powder.

![Figure 2. Dadih Powder in Freezing (a), Product of Dadih Powder (b)](image)

4. Conclusion
The dadih powder was produced as a supplementary food combined with local food source with appropriate nutritional content. From this dadih powder, it can obtain 91.6 kcal, 6.2 g protein, 6.8 g fat, and 1.4 g carbohydrate. Processing of dadih to be powder can survive lactic acid bacteria $4.6 \times 10^6$ CFU/ml. Therefore, this product can be given to pregnant mothers and children under two years of age to prevent stunting.

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References
[1] Pato Pato U, Ali M, and Parlindungan AK 2005 Taurocholate Deconjugation and Cholesterol Binding by Indigenous Dadih Lactic Acid Bacteria Hayati 12 (3) 103-107.
[2] Surono IS 2015 Traditional Indonesian Dairy Food. Asia Pacific Journal of Clinical Nutrition 24 (suppl 1) S26-S30.
[3] Kennas A, Amellal-Chibane H, Kessal F, and Halladj F 2018 Effect of Pomegranate Peel and Honey Fortification on Physicochemical, Physical, Microbiological and Antioxidant Properties of Yoghurt Powder Journal of the Saudi Society of Agricultural Sciences doi.org/10.1016/j.jssas.2018.07.001.
[4] Drouault S and Corthier G 2001 Effect Des Bacteries Lactiques Ingerées Avec Des Laits Fermentes Sur La Sante. Vet. Res32 101-117, doi: 10.1051/vetres:2001115.
[5] Helmizar, Elya Yuswita, and Andani Eka Putra 2019. Analysis of the Nutrients and Microbiology Characteristics of the Indonesian Dadih As a Food Supplementation. Global Journal of Health Science; Vol.11, No,1 P 155-161.
[6] AOAC 2005 Official method of Analysis. 18th Edition, Association of Officiating Analytical Chemists, Washington DC, Method 935.14 and 992.24.
[7] Helmizar 2018 The Effect of Dadih and Zinc Supplementation During Pregnancy on Humoral Immune Response and Birth weight of Infants in West Sumatera Province. The Progress Report to Danone Institute Foundation Indonesia. Faculty of Public Health Andalas University.
[8] Martorell R, Bernardo LH, Linda SA, Aryeh DS 2009 Weight gain in first two years of life is an important predictor of schooling outcomes in pooled analyses from five birth cohorts from low and middle income countries. J Nutr. 109348-353 doi: 103945/jn.109.112300.
[9] Akgun A, Yazici F, and Gulec HA 2016 Effect of Reduced Fat Content on the Physicochemical and Microbiological Properties of Buffalo Milk Yoghurt. LWT Food Science and Technology. doi: 10.1016/j.lwt.2016.08.015.
[10] Salman M, Khaskheli M, Isral-Ul-Haq, Talpur AR, Khuhro AP, Rauf M, Hamid H, and Aziz A 2014 Comparative Studies on Nutritive Quality of Buffalo and Cow Milk. International Journal of Research in Applied, Natural and Social Science2 (12) 69-77.
[11] Han X, Lee FL, Zhang L, and Guo MR 2012 Chemical Composition of Water Buffalo Milk and Its Low-Fat Symbiotic Yogurt Development. Function Foods in Health and Disease2 (4) 86-106.
[12] Soomro AH, Brohi SA, Khaskheli M, and Nizamani AH 2012 Fermentability and Rheological Properties of Lactoperoxidase Activated Buffalo Milk Yoghurt. Journal of Microbiology, Biotechnology and Food Sciences 2 (3) 983-997.
[13] Ishak R, Mustafà F, and Sipat A 2006 Influence of Inulin Addition on Physical Properties and Sensory of Dadih Journal of Applied Sciences 6 (5) 1128-1131.
[14] Collado MC, Surono IS, Meriluoto J, and Salminen S 2007 Potential Probiotic Characteristic of Lactobacillus and Enterococcus Strains Isolated from Traditional Dadih Fermented Milk Against Pathogen Intestinal Colonization Journal of Food Protection 70 (3) 700-705.
[15] Yatmiko YD, Howart GS, and Barton MD 2017 Assessment of Probiotic Properties of Lactic Acid Bacteria Isolated from Indonesian Naturally Fermented Milk AIP Conference Proceedings 1908, 050008. doi: 10.1063/1.5012732.

[16] Lira de Medeiros AC, Thomazini M, Urbano A, Correia RTP, and Favaro-Trindade CS 2014 Structural Characterisation and Cell Viability of a Spray Dried Probiotic Yoghurt Produced with Goat’s Milk and Bifidobacterium animalis subsp. lactis. International Dairy Journal. doi: 10.1016/j.idairyj.2014.05.08.

[17] Marchal L, Aymard P, Geysel Y, Daval C, Jessenne P, Lecroix F 2009 Powder of Fermented Milk or of Yoghurt With a High Density of Lactic Ferments. United States Patent Application Publication US 2009/0304864 A1.