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Original Article

Comparative Analysis of Sensory, Chemical, and Microbiological Properties of Dadih from Different Regions in West Sumatra, Indonesia

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ABSTRACT

Background: Dadih, a traditional fermented buffalo milk from West Sumatra, Indonesia, varies in quality depending on its production region. This study aimed to compare the sensory, chemical, and microbiological properties of Dadih, a traditional fermented buffalo milk, from different regions of West Sumatra, Indonesia, to identify quality variations and their potential determinants. **Method**: Samples were collected from Payakumbuh, Batusangkar, Bukittinggi, and Alahan Panjang. Sensory evaluation assessed taste, aroma, color, and texture; chemical analysis measured pH and protein content; and microbiological analysis determined total lactic acid bacteria (LAB) counts. **Results:** Sensory results showed significant differences in texture ($p=0.004$) and aroma ($p<0.001$), with Payakumbuh samples scoring highest in these parameters. Chemical analysis revealed Payakumbuh Dadih had the lowest pH (4.60 ± 0.32) and highest protein content (8.91 ± 0.22%). The highest LAB count was found in Batusangkar samples (9.3×10^8 CFU/g). **Conclusion:** The study concluded that Dadih in West Sumatra exhibited diverse properties influenced by regional processing practices, hygiene, and raw material sources. These findings provide a basis for improving production techniques to enhance sensory quality, nutritional value, and functional food potential.

INTRODUCTION

Dadih is an indigenous fermented dairy product and a hallmark of Indonesia's gastronomic heritage, originating from West Sumatra, Indonesia(Taufik, 2004). It is produced via spontaneous fermentation in bamboo containers, a traditional method deeply rooted in local practices. This product has a unique sensory profile and contains functional components with potential health benefits(Usmiati & Risfaheri, 2013). Compared to other dairy products, Dadih is rich in high-quality protein, essential amino acids, B-complex vitamins, and minerals such as calcium, phosphorus, and magnesium (Putri, Juliyarsi, Roza, & Purwati, 2021; Soenarno, Polii, Febriantosa, & Hanifah, 2013). The fermentation process, predominantly mediated by *Lactobacillus plantarum*, enhances digestibility and bioavailability while producing bioactive metabolites—including peptides, exopolysaccharides, and antimicrobial compounds which is associated with antioxidant, antimicrobial, immunomodulatory, and hypocholesterolemic effects (Kodariah, Armal, Wibowo, & Yasmon, 2019; Venema & Surono, 2019). The functional properties of dadih make it an attractive product that can be developed into a functional food for health (Chorawala, Oza, & Shah, 2011; Usmiati & Risfaheri, 2013).

In West Sumatera, several areas are well-known as Dadih producers, including Payakumbuh, Bukittinggi, Alahan Panjang, and Padang Panjang. Interestingly, each area has different ways of processing Dadih. As a result, they produce different product quality (Suresti, Aritonang, & Wati, 2018). Each region applies distinct production parameters such as fermentation duration, ambient temperature, bamboo type, hygienic practices, and storage conditions. These regional differences significantly affect the organoleptic properties, nutritional composition, and microbiological quality of dadih, resulting in heterogeneous product characteristics (Putra, Marlida, Azhike, & Wulandari, 2011). Research on *Dadih* is still limited. Most studies focus on individual aspects, such as nutrient content, microbial types, or specific functional compounds, and are usually based on samples from only one location. Few studies have compared sensory, chemical, and microbiological qualities of *dadih* across different production regions. Therefore, how regional production methods affect the overall quality of *Dadih* is still not well understood.

This approach enables the identification of strengths and weaknesses unique to each region, offering new insights not previously reported in national or international studies. Such a comprehensive analysis is crucial for understanding how regional production factors influence *dadih* quality, thereby guiding focused quality enhancements and the preservation of its unique characteristics. The urgency of this research is underscored by growing domestic and international demand for safe, high-quality traditional and functional foods. Without rigorous scientific data on regional quality variations and their determinants, Dadih's unique sensory and nutritional characteristics may be compromised by inconsistent processing or lack of standardization.

Therefore, this study aims to compare the sensory, chemical, and microbiological profiles of Dadih from four principal production regions in West Sumatra, Indonesia, to identify quality variations and underlying factors. The results are expected to inform evidence-based strategies for quality enhancement, authenticity preservation, and promote Dadih as a competitive functional food in both domestic and global markets.

METHODS

Research Design

This study employed a descriptive comparative design to evaluate sensory, chemical, and microbiological properties of *Dadih* from four distinct production regions in West Sumatra, Indonesia: Payakumbuh, Batusangkar, Bukittinggi, and Alahan Panjang. The study was conducted from January to March 2024. All samples were collected after two days of fermentation and stored at refrigerator temperatures (≤10°C) until testing to preserve product.

Sampling Procedure

A total of eight *Dadih* samples were collected, with two samples obtained from one household producer in each region. Producers were selected based on local reputation and accessibility to represent regional production practices. Samples were collected aseptically on the second day of fermentation, transported in ice boxes, and processed immediately or stored under refrigeration until analysis.

Materials and Equipment

This study employed Dadih from Payakumbuh, Batusangkat, Bukittinggi, and Alahan Panjang as materials. They were taken on the second day of fermentation. Other materials included CuCl2.2H2O DPPH (1,1- diphenyl-1-picrylhydrazyl) and other relevant chemicals. Meanwhile, tools used in this study included an ice *box*, UV-Vis spectrophotometer, burette and stative, Erlenmeyer, suction rubber, watch glass, dropper pipette, measuring flask, and volume pipette.

Sensory Evaluation

Sensory testing was performed using a hedonic scale assessing color, taste, texture, and aroma. Twenty semi-trained panelists, selected based on prior sensory experience and brief orientation training—including familiarization with sensory attributes and hedonic scoring—evaluated the samples. Each *Dadih* sample was tested in triplicate to ensure reproducibility. Panelists rated attributes on a 5-point scale: 1 (strongly dislike), 2 (dislike), 3 (slightly like), 4 (like), and 5 (very like) (Popper & Kroll, 2011).

Proximate Analysis

Proximate analysis was carried out to measure Dadih's chemical characteristics. Specifically, it measured the contents of water, ash, protein, fat, carbohydrate, and fiber. Analysis uses AOAC Method. The procedures for each parameter in proximate analysis are described as follows:

- Water Content

  This procedure began by cleaning and drying the dish at 105^o C for 3 hours After drying, the dish was cooled in a desiccator. The weight of the empty dish (W1) was then recorded. Next, 3 grams of the sample was weighed and placed in the oven at 105^o C for 3 hours. After drying, the sample was transferred to a desiccator and cooled. Then, the sample did the final weighing (W2).(Amalia, Pindona, Rusdiana, & Pratiwi, 2023)

  Moisture content (%) = (W1- W2)/W1 x 100%

- Ash Content

  The next procedure was to measure the ash content. It began by drying the crucible in the oven at 105°C for 1 hour. The crucible was cooled for 15 minutes in a desiccator and weighed. A sample of 1.5–2 grams was placed into the crucible, which was then placed in a furnace at 600°C for 3 hours. After cooling the furnace to approximately 120°C, the crucible was transferred into a desiccator. Finally, the crucible and its contents (ash) were weighed to obtain a constant weight.(Amalia et al., 2023)

  Ash content (%) = ash weight/sample weight x 100%

- Fat content

  Fat content in Dadih samples was quantitatively determined using the Soxhlet extraction technique in accordance with standard analytical protocols. Approximately 5 grams of homogenized, dried sample were placed into a cellulose extraction thimble and subjected to continuous solvent extraction with hexane as the organic solvent. The solvent was refluxed, evaporated, and condensed to repeatedly percolate through the sample, effectively dissolving the lipid fraction. Post-extraction, the solvent was evaporated to isolate the extracted fat, which was weighed gravimetrically. Fat content was expressed as a percentage relative to the initial sample mass, ensuring precise quantification of total lipid concentration within the sample matrix.

  - $$Fat\ content\ (\%) = \frac{Weight\ of\ extracted\ fat\ (g)}{Weight\ of\ original\ sampel\ (g)} x\ 100\%$$

- Carbohydrate content

  Carbohydrate content was determined by difference, calculated as the remaining percentage after subtracting the measured values of moisture, protein, fat, ash, and fiber from 100%. This indirect method assumes that the sum of all analyzed components accounts for the total composition of the sample, thereby estimating carbohydrate content as the residual fraction.

- Protein Content

  Protein content was tested using the Kjeldahl method of the AOAC method.(AOAC, 1999) It was tested through the following stages:

  a. Deconstruction stage

  Samples were taken and mashed thoroughly. Approximately 1 gram of the sample was weighed and placed into a Kjeldahl flask. To facilitate digestion, 2 grams of a mixed catalyst and 25 mL of concentrated H_2SO_4 were added while stirring gently until a homogeneous solution was obtained. The solution was then heated to boiling until its color changed to a clear green.

b. Distillation stage

In this stage, the cooled deconstructed solution was diluted with 100 ml of distilled water in a 100 ml volumetric flask. The solution was pipetted 5 ml into a distillation flask. To separate ammonia from the sample solution, 30% NaOH was added to the alkaline solution. A few boiling stones were also added to prevent bumping during distillation. The solution was distilled, and the distillate was collected in an Erlenmeyer containing 10 ml of 2% boric acid solution and a few drops of mixed indicator (methylene red + bromothymol blue). The distillation occurred for approximately 5-10 minutes.

c. Titration stage

The distillate was titrated with 0.01 N hydrochloric acid standard solution. The endpoint of the titration was indicated by a color change from blue to orange. A blank was also prepared and treated in the same manner as the sample. The percentage of the protein was calculated by the following formula:

$$\%N = \frac{(\text{ml NaOH blank} - \text{ml NaOH sample}) \text{ x NaOH normality x } 14.008 \text{ x } 100\%)}{\text{gr sample}} \, x \, 1000$$

$$\% \text{ Protein} = \% \text{ N x } 6.25$$

pH testing

The next was pH testing, which was done using a pH meter dipped into the dadih.(AOAC, 1999)

Lactic acid bacteria testing

The total lactic acid bacteria in the samples were measured using the pour plate method. Samples were first serially diluted to ensure accurate colony counting. Then, 1 ml of the appropriately diluted sample was placed into a sterile petri dish. Cooled, sterile MRS agar was carefully poured into the petri dish containing the sample. The dish was gently swirled to evenly distribute the bacteria throughout the medium. Plates were then incubated in an inverted position at 41°C for 48 hours, which is considered optimal for the growth of mesophilic LAB commonly present in Dadih. After incubation, bacterial colonies were counted using a colony counter, and the total number of LAB was calculated as colony-forming units per milliliter (CFU/mL) of sample (Jannah, Legowo, Pramono, & Al-baarri, 2014).

Statistical Analysis

Data were analyzed using SPSS version 19.0. Descriptive statistics, including means and standard deviations, were calculated for all variables. For sensory evaluation data and other parametric measurements, inferential statistics were performed to assess significant differences between treatments. Specifically, one-way analysis of variance (ANOVA) was used, followed by Tukey's post hoc test for multiple comparisons when significant differences were detected. A significance level of $p < 0.05$ was applied throughout.

RESULTS

Dadih Producing Region

Dadih is a traditional drink native to Minangkabau. Nevertheless, the drink is relatively difficult to find because the amount of Dadih production is very low. Dadih-producing areas were initially quite numerous, but over time, many farmers did not continue the production of the drink. Some of the reasons are the difficulty in raising buffaloes and the demand for Dadih is still limited. In addition, only a few people know and consume this traditional drink. Dadih in each region can only be found in 1-2 sellers. Even so, they have very small amount of Dadih, no more than 20 tubes. In West Sumatra, Dadih is currently produced in four areas: Bukittinggi, Batusangkar, Payakumbuh, and Alahan Panjang. Figure 1 shows the spread of the Dadih-producing areas. Dadih producers are all geographically dispersed in both highland and lowland areas.

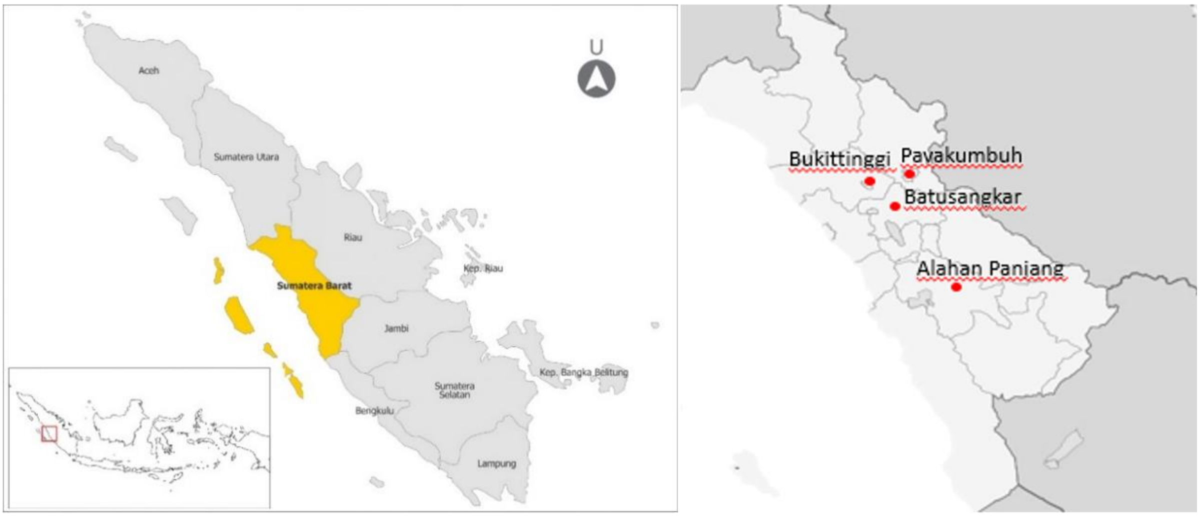

Figure 1. Location map of Dadih producers in West Sumatra

Dadih Making Process

In West Sumatra, Dadih is still produced using traditional methods. Figure 2 illustrates the process, from buffalo milking to product distribution and sales in Alahan Panjang. The production begins with milking, which can only be performed after the buffalo has given birth. Farmers typically carry out milking every morning, no later than 9 a.m. The collected milk was then stored in bamboo milk containers for a maximum of 2 hours. This study found that the milk containers were only rinsed using water, without cleaning agents or sanitizers. The cleaning technique was still very simple and did not meet food safety requirements.

Figure 2: Process of making Dadih

While Dadih production in West Sumatra follows this traditional approach, production methods may differ in other regions of Indonesia. For example, some areas may employ more hygienic practices, such as cleaning the udder and using sanitized containers, or even incorporate modern fermentation controls to improve product safety and consistency. These regional differences can influence both the microbial composition and the quality of the final Dadih product.

Sensory Properties

The sensory evaluation of Dadih from four regions—Batusangkar, Bukittinggi, Payakumbuh, and Alahan Panjang—is presented in Table 1. No significant differences were observed in color ($p = 0.256$) or taste ($p = 0.594$) among the regions, indicating that visual appearance and flavor were relatively consistent across samples. In contrast, texture and aroma varied significantly among regions ($p = 0.004$ and $p < 0.001$, respectively). Dadih from Payakumbuh received the highest texture score (4.33 ± 0.61), while Alahan Panjang scored the lowest (3.27 ± 1.03). Similarly, Payakumbuh Dadih had the highest aroma rating (2.67 ± 0.72), whereas Alahan Panjang scored lowest (2.13 ± 0.74). These results suggest that regional differences in milk handling and fermentation practices influence the development of texture and aroma in Dadih. The overall acceptability followed a similar trend, with Dadih from Payakumbuh scoring highest (3.40 ± 0.80) and Alahan Panjang lowest (2.80 ± 0.59). This pattern reflects the combined effects of texture, aroma, and other sensory attributes on consumer perception. Figure 3 shows the visualization dadih from various area. Dadih from payakumbuh more white and bright color between other area.

Table 1. Sensory profile of Dadih from different regions in West Sumatra

Parameters	Batusangkar	Bukittinggi	Payakumbuh	Alahan Panjang	*p-value*
Color	3.60±0.50	3.80±0.56	3.80±0.86	3.33±0.72	*0.256*
Taste	2.80±0.67	2.67±0.61	2.80±0.77	2.47±0.74	*0.594*
Texture	3.67±0.61	3.67±0.61	4.33±0.61	3.27±1.03	*0.004**
Aroma	2.40±0.82	2.40±0.73	2.67±0.72	2.13±0.74	*0.000**
Overall	3.12±0.64	3.13±0.70	3.40±0.80	2.80±0.59	

1. Batusangkar 2. Bukittinggi 3. Payakumbuh 4. Alahan Panjang

Figure 3. Visualization of Dadih

Chemical Properties

The proximate composition and energy content of *dadih* samples from four regions in West Sumatra are presented in Table 2. The total energy content of *dadih* varied among regions, with the highest value observed in Payakumbuh (171.85 ± 1.87 kcal/100 g) and the lowest in Bukittinggi (113.75 ± 1.37 kcal/100 g). The contribution of energy from fat followed a similar trend, ranging from 101.21 ± 2.61 kcal/100 g in Payakumbuh to 53.69 ± 1.72 kcal/100 g in Alahan Panjang.

Water content differed significantly between regions, with the highest moisture detected in Bukittinggi (80.56 ± 0.13%) and the lowest in Batusangkar (69.56 ± 0.20%). Total fat content was highest in Payakumbuh (11.25 ± 0.29%) and lowest in Alahan Panjang (5.97 ± 0.19%). Protein content showed slight regional variation, ranging from 7.66 ± 0.01% in Bukittinggi to 8.91 ± 0.22% in Payakumbuh. Carbohydrate content was highest in Batusangkar (12.87 ± 0.15%) and lowest in Bukittinggi (2.76 ± 0.01%). Ash content was relatively consistent across Batusangkar, Bukittinggi, and Payakumbuh (0.99–1.06%), whereas Alahan Panjang exhibited a high variation (6.08 ± 7.10%).

The pH values of the *dadih* samples ranged from 4.60 ± 0.32 in Payakumbuh to 5.70 ± 0.21 in Alahan Panjang, indicating slight differences in acidity among the regions. Overall, *dadih* from Payakumbuh showed the highest energy and fat content, whereas Bukittinggi samples were characterized by higher moisture and lower energy values.

Table 2. Dadih content from different regions in West Sumatra

Parameters	Unit	Batusangkar	Bukittinggi	Payakumbuh	Alahan Panjang
Total Energy	Kcal/100 g	162.27±1.87	113.75±1.37	171.85±1.87	123.41±0.59
Energy from Fat	Kcal/100 g	80.01±1.78	72.09±1.40	101.21±2.61	53.69±1.72
Ash Content	%	0.99±0.22	1.02±0.02	1.06±0.01	6.08±7.10
Water Content	%	69.56±0.20	80.56±0.13	70.04±0.12	75.53±0.12
Carbohydrates	%	12.87±0.15	2.76±0.01	8.76±0.04	9.49±0.10
Total Fat Content	%	8.89±0.20	8.01±0.16	11.25±0.29	5.97±0.19
Protein Content	%	7.70±0.17	7.66±0.01	8.91±0.22	7.94±0.18
pH	points	4.75±0.44	5.16±0.11	4.6.±0.32	5.7±0.21

Microbiological characteristics

The total lactic acid bacteria (LAB) counts in *dadih* samples from different regions of West Sumatra are shown in Table 3. LAB levels varied considerably among the regions. *Dadih* from Batusangkar exhibited the highest LAB count (9.3 × 10^8 colonies/g), followed by Payakumbuh (6.8 × 10^8 colonies/g). Bukittinggi samples contained a lower LAB population (1.6 × 10^8 colonies/g), while Alahan Panjang had the lowest count (1.6 × 10^7 colonies/g).

Table 3. Total LAB of Dadih from various regions in West Sumatra

Parameters	Unit	Batusangkar	Bukittinggi	Payakumbuh	Alahan Panjang
Total Lactic Acid Bacteria	colonies/gr	9.3 x 10^8	1.6 x 10^8	6.8 x 10^8	1.6 x x 10^7

These results indicate significant regional differences in microbial content, with *dadih* from Batusangkar and Payakumbuh having a higher probiotic potential due to the elevated LAB levels compared to Bukittinggi and Alahan Panjang. The variation in LAB counts may reflect differences in traditional fermentation practices, raw milk composition, and local environmental conditions.

DISCUSSION

Generally, Dadih producers make this product only as a distraction or additional business. Most of them are farmers who work to cultivate the land by utilizing buffaloes. They can only produce Dadih when their buffaloes give birth and can produce milk. The milking period is generally only 1 year after giving birth (Arote, Siddiqui, MD, & SD, 2021). During the milking process, farmers must milk the buffalo with calves present. If the calf does not suckle, the buffalo cannot produce milk. In general, farmers own only 1 to 3 buffaloes, which limits the availability of buffalo milk.

Observations in this study revealed that farmers did not use gloves or thoroughly clean the udder before milking. These practices may increase the risk of contamination, introducing various pathogenic bacteria into the milk, including *Salmonella* spp., *Escherichia coli*, *Klebsiella pneumoniae*, *Staphylococcus aureus*, *Klebsiella oxytoca*, and *Citrobacter freundii* (Berhe, Wasihun, Kassaye, & Gebreselasie, 2020).

The study also observed traces of milk and sour aroma left in the container. This condition increases the risk of bacteria contamination, such as *Moraxellaceae, Staphylococcaceae, and Enterobacteriaceae,* in the milk containers (Du et al., 2020). After preparing the bamboo container, the farmers in this study put the milk into the bamboo for fermentation. During the fermentation, the bamboo was carefully prepared. For example, bamboo that has been cut was stored in a closed condition. Alternatively, the surface with air contact was faced down. It aims to avoid contamination by airborne bacteria such as *Streptococcus aureus and Listeria monocytogenes* that might infect the product (Kozajda, Jeżak, & Kapsa, 2019; Tjampakasari, 2021).

During the Dadih making, natural bacteria were derived from the powder inside the bamboo, namely lactic acid bacteria in the form of *Lactobacillus sp, Lactobacillus plantarum, Lactococcus, and Leuconostoc sp* (Miwada et al., 2011). Typically, farmers use two methods. First, the powder is scraped, and then milk is added. Another method is to directly insert milk into the bamboo without scraping it. Although these methods are common, it is important to note that each region in West Sumatra has certain characteristics in making Dadih. Finally, the fermentation process generally takes 1-2 days.

Payakumbuh dadih has a whiter and brighter color than other regions. The resulting color comes from the milk used as raw material. Clean milk will produce a whiter Dadih color (Marco, 2017). Scholars argue that various factors affect the color of milk, including cow breed, lactation stage, parity, milking time, udder health status, feed, and calving season (Scarso et al., 2017). In addition to color, the soft and creamy texture of the Dadih was highly favored by the panelists. This texture is presented by the fat content in the Dadih. The higher the fat in the Dadih, the better the texture. In addition, the fermentation process that occurs in Dadih also affects its viscosity. Dadih becomes thicker, even like jelly or curd. During fermentation, the activity of certain microorganisms forms a protein gel that strengthens the structure between proteins, thus affecting the viscosity of the Dadih (Hoxha, Evstatieva, & Nikolova, 2023).

The present study also confirms the contribution of carbohydrate fermentation, proteolytic activity, and lipid metabolism in creating the desired Dadih structure and flavor. In carbohydrate catabolism, small amounts of flavor compounds, such as volatile fatty acids, ethanol, acetoin, acetic acid, *butanone, diacetyl,* and *acetaldehyde,* are formed (Hosono, Wardojo, & Otani, 1989; Ingrid Suryanti Surono, 2016). As the main fermentation product, lactic acid is produced by homofermentative LAB, such as *Lactobacilli, Lactococci, Pediococci,* and *Streptococci.* Meanwhile, the flavor is formed by heterofermentative LAB, such as *Levilactobacillus brevis*, *Limosilactobacillus fermentum,* and *Leuconostoc sp*. Lactic acid formed by LAB contributes to the destabilization of casein micelles to form Dadih and imparts a distinctive and characteristic sharp, acidic flavor (Ingrid Suryanti Surono, 2016).

This section looks into the chemical characteristics of Dadih. It was done by looking at the nutrient content and pH of the Dadih. First, this study found that the nutritional content of Dadih from each region varied, as shown in Table 2. Based on the nutritional content, it was known that the Dadih from Payakumbuh had the best value compared to other regions. For instance, the protein content of Payakumbuh Dadih reached 8.91% Meanwhile, the fat content was 11.25%, and the carbohydrates were 8.76%. This study believed that the nutritional content was strongly influenced by the raw materials used in making Dadih. Dadih made in Payakumbuh employed milk from mud/swamp buffalo. However, no empirical evidence correlates the types of buffalo and the nutritional content of milk they produce. Hence, further research is needed to determine the differences in the nutritional content of milk produced by different buffalos. Future research can also be directed to observe the breeding process to obtain the most potential buffalo to increase Dadih productivity (Marco, 2017).

Another key finding in the chemical characteristics is the pH value. In this study, the pH of Dadih was around 4.75-5.70, higher than that of other fermented products, such as yogurt, with a range of 3.80-4.50 (Jonathan, Fitriawati, Arief, Soenarno, & Mulyono, 2022). The pH value in Dadih results from the fermentation process of lactic acid bacteria, mainly *Lactobacillus plantarum* (Hoxha et al., 2023). LAB converts lactose into lactic acid by involving β-galactosidase and lactic acid fermentation. The lactic acid lowers the pH value of buffalo milk and contributes to protein precipitation or clumping of buffalo milk, resulting in the formation of Dadih. A decrease in pH value from 6.92 (raw buffalo milk) to 4.65 after 2 days of Dadih fermentation was observed (Y. D. Jatmiko, Howarth, & Barton, 2019).

The last aspect discussed in this study is the microbiological profile of Dadih. This profile can be seen from the total lactic acid bacteria. In this study, the number of lactic acid bacteria in Dadih per gr was quite high, ranging from 1.6×10^7 to 9.3×10^8. This value was considered quite high and good. As provided in Table 3, Dadih from Payakumbuh has the highest total LAB value compared to others. The lactic acid bacteria content offers health benefits to consumers by improving the intestinal microbiota, which in turn can positively impact metabolism and overall health (Chioma, Hesse, Chapman, & Drake, 2021).

The fermentation process in Dadih lasts for 1-2 days at a temperature of 28-30° C. Fermentation occurs spontaneously by involving various microorganisms, mainly LAB and yeast. LAB will grow during fermentation. In this study, various lactic acid bacteria were found in the making of buffalo milk Dadih, including *Leuconostoc mesenteroides*, *Lactococcus lactis subsp*. *lactis, Levilactobacillus brevis*, *Lacticaseibacillus casei*, *Lactiplantibacillus plantarum subsp. plantarum, Enterococcus faecium, Limosilactobacillus fermentum,* and *Lacticaseibacillus rhamnosus* (Nuraida, 2015). These bacteria suppress the growth of pathogenic and spoilage bacteria that can cause product damage and health problems (Parasthi, Afifah, Nissa, & Panunggal, 2020; Ingrid S. Surono, 2003). The study observed that the process of Dadih making in Batusangkar and Payakumbuh tends to be more hygienic than in other areas. This can be known from the equipment used that has good standards, including using standardized stainless and food-grade plastic (Chountalas, Tsarouchas, & Lagodimos, 2009). This is important because unhygienic processes in Dadih production allow contamination with pathogenic bacteria, such as *Enterococcus faecalis* (Maslami et al., 2018; Terzić-Vidojević, Veljović, Popović, Tolinački, & Golić, 2021). The process of making dadih can be done through the back-slopping method, which is making fermentation using the previous dadih seedlings (Shrivastava & Ananthanarayan, 2014). This method affects the diversity of LAB in the Dadih because back-slopping fermentation produces greater diversity than spontaneous dadih fermentation(Wirawati, Sudarwanto, Lukman, Wientarsih, & Srihanto, 2019).

Besides LAB, yeast was also commonly found in Dadih. There are three species of yeast that are often found in Dadih: *Saccharomyces cerevisiae*, *Candida metapsilosis*, and *Kluyveromyces marxianus* (Y. D. Jatmiko et al., 2019). Other yeast species found in dadih were *Candida stelimalicola* and *Pichia.*(Yoga Dwi Jatmiko, de Barros Lopes, & Barton, 2012). This study did not evaluate the amount of yeast in the Dadih, but some studies mentioned that the total yeast in the Dadih reached 7.08×10^6 cfu/g (Arnold, Rajagukguk, & Gramza-Michałowska, 2021). Yeast and LAB grow simultaneously, which begins with the LAB growth, which can produce organic acids as a means of yeast growth. On the other hand, yeast can provide growth factors for LAB by increasing the production of vitamins and soluble nitrogen components.(Resende et al., 2018)

Several limitations should be noted. First, this study was observational and did not include controlled experimental trials to directly test the impact of specific variables, such as buffalo breed, feed, or milking hygiene, on dadih quality. Second, the study did not quantify yeast populations, which may also influence flavor development and fermentation dynamics. Third, seasonal and lactation variations were not systematically controlled, which could affect milk composition and subsequent Dadih characteristics. Finally, the sample size per region was limited, which may constrain the generalizability of the findings. Future studies should address these limitations by incorporating controlled experiments, larger sample sizes, and detailed monitoring of milk and environmental factors to better understand the determinants of dadih quality.

CONCLUSION

Dadih produced in West Sumatra exhibits notable regional variations in sensory, chemical, and microbiological properties. Payakumbuh Dadih showed the highest nutritional quality, with superior protein, fat, and carbohydrate content, as well as the highest lactic acid bacteria counts (6.8×10^8 colonies/g), indicating strong probiotic potential. Differences in fermentation practices, raw milk quality, and hygiene significantly influenced these variations.

The study confirms that both traditional processing methods and the quality of buffalo milk are key determinants of Dadih's texture, flavor, acidity, and microbial profile. These findings provide a scientific basis for improving production practices, ensuring product safety, enhancing nutritional and sensory quality, and promoting Dadih as a competitive functional food in local and international markets. It is recommended to standardize the Dadih production process, including raw materials, processing methods, and storage conditions, to ensure consistent product quality.

Author Contributions Statement: Nur Ahmad Habibi: Conceptualization, Methodology, Supervision, Writing – Original Draft Preparation. Gusnedi: Investigation, Formal Analysis. Edmon: Investigation, Data Curation. Citra Tristi Utami: Writing – Review and Editing, Supervision. Darwel: Data Curation, Formal Analysis. All authors have read and approved the final manuscript and agree to be accountable for all aspects of the work.

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