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Improvement of the Quality of Tofu Pulp and Fermented Coconut Pulp of Baker's Yeast on the Content of Fiber, Fat and BETN

David A. Nguru[1], Alberth N. Ndun[1], Simon E. Mulik[1], Alvrado B. Lawa[1], Nitty C. Mafefa[1], Nautus S. Dalle[2]

[1]Fakultas Peternakan, Kelautan dan Perikanan Universitas Nusa Cendana

[2]Program Studi Peternakan, Fakultas Pertanian dan Peternakan, Universitas Katolik Indonesia Santu Paulus Ruteng,

ABSTRACT: The purpose of the study was to determine the improvement of the quality of tofu pulp and coconut pulp fermented using baker's yeast on the content of fiber, fat and BETN to be used as an ingredient for livestock processing. Tofu pulp waste comes from a tofu factory located in Oesapa Village, Kelapa Lima District, Kupang City. Meanwhile, tofu pulp is the leftover product of processing coconut milk from households and stalls in the Kupang city area and its surroundings. The research method uses direct experimental methods and fermentation time duration through proximate analysis. The results of this study were tested using the t Student test with the treatment of R1 (fermented tofu pulp and coconut pulp waste for 12 hours), R2 (fermented tofu pulp and coconut pulp waste for 24 hours) and R3 (fermented tofu pulp and coconut pulp waste for 48 hours). The variables studied were changes in the nutritional content of crude fat (LK), crude fiber (SK) and fermented non-nitrogen extract (BETN). The results of the study showed that the treatment had an effect on the research variables. The conclusion of this study is that tofu pulp and coconut pulp waste fermented with bread yeast increases the nutrient content, so that it can be used as a source of animal feed.

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Corresponding Author: David A. Nguru

KEYWORDS: tofu pulp waste, coconut pulp, fermentation, baker's yeast

1. INTRODUCTION

Pig livestock is a type of monogastric livestock that is able to grow quickly and efficiently and can produce meat in a relatively short period of time to meet the community's needs for animal protein (Nguru *et al.* 2024). In addition to meeting the needs of animal protein, people's interest in consuming pork is also influenced by the increase in processed pork culinary. One of the most popular processed pork dishes is pork se'i. Se'i meat is meat processing by smoking using kosambi wood so that it has a distinctive and long-lasting taste (Buntu *et al*., 2020). The distinctive taste of pork products causes the demand for meat to increase (Sabat *et al*., 2018). The increasing demand for meat is in line with the public's interest in raising pigs. The increase in pork demand is not supported by the productivity of pig livestock.

Pig productivity is affected by the balance of feed nutrient content. Suryani *et al*., (2021) also reported that the productivity of pig livestock is affected by complete nutritional intake. The nutritional balance of feed requires considerable costs. Where the biggest cost is the cost of feed which reaches 65-80% of the total production cost (Matialo *et al*., 2020). The quality and quantity of nutrients greatly determine the value of a feed ingredient. Masriah *et al*., (2022) report that the value of a feed ingredient is highly determined by the quality and strength of the nutrients contained in the feed ingredient. The high price of feed ingredients makes farmers provide potluck feed without paying attention to the daily needs of pigs (Nguru *et al*. 2023). One of the solutions to overcome the problem of feed costs is to utilize waste which is cheap and abundant in availability. Waste that has the potential to be used as feed ingredients is tofu pulp and coconut pulp. The use of tofu pulp and coconut pulp as pig feed has the potential to reduce waste and can reduce feed costs. Marhamah *et al*., (2019) reported that tofu pulp and coconut pulp are waste that have the potential to be used as animal feed ingredients, because they have a significant protein content. These two wastes, if not utilized and left untreated, will rot and can cause an unpleasant odor so that it has a negative impact on the environment.

Tofu pulp is the leftover material produced after the tofu making process (Yuliani & Mardesci, 2017). Tofu is made from soybeans that are soaked, ground, boiled, and then filtered to separate the soybean juice from the pulp (Tanjung *et al*., 2023). There are two categories of waste produced by tofu factories, namely liquid waste is the result of the boiling and washing process of soybeans, while solid waste, better known as tofu pulp, is the rest of soybeans that have been crushed (Sari *et al*., 2018). Bapedal,

(1994); Rukmini, (2021) reported that the content of tofu solid waste is protein (23.35%), fat (5.54%), carbohydrates (26.92%), ash (17.03%), and water (10.53%). Nuraini (2009); Rais *et al*., (2021) also reported that tofu pulp has a crude protein content of 27.55%, as well as other nutritional conjectures such as crude fiber of 7.11%, crude fat of 4.93% and BETN of 44.50%

Coconut pulp is a by-product of coconut milk extraction (Pusuma *et al*., 2018). Jailani & Umar, (2021) reported that coconut pulp is household waste that can be used as animal feed but has the potential to pollute the environment. Unused coconut pulp can pollute the environment (Nofiyanti *et al*., 2021). Coconut pulp can be used as an alternative feed ingredient so that it can reduce production costs while increasing profits (Dwiyana *et al.*, 2021). Coconut pulp has a fairly high nutritional content with water content of 11.31%, crude protein 5.78%, crude fat 38.24%, carbohydrates 23.77%, ash 5.92%, and crude fiber 15.07% (Putri, 2010; Laksono *et al*., 2023).

The use of tofu pulp and coconut pulp as animal feed ingredients has challenges related to materials that are prone to decay, thus affecting the storage time. To increase the storage duration of feed ingredients, one of the solutions that can be applied is through the fermentation process. Fermentation can increase the storage time and can increase the nutritional content of feed ingredients (Nguru *et al.*, 2022). This is supported by (Thaariq, 2018) reporting that fermentation can increase the storage time of feed ingredients. In addition, fermentation is a method to increase the nutritional content of feed ingredients by involving microorganisms. Alwi *et al*., (2022) It is also reported that fermentation is a way to improve nutrition from low-quality materials by utilizing feed processing technology that is carried out biologically by involving the activity of microorganisms. Fermentation processing has advantages such as extending storage time, eliminating unpleasant odors, increasing nutritional value better than the original ingredients, fermented food is easier to consume and increasing digestibility *(Laoli et al*., 2020). Ingredients that can be used in fermentation are baker's yeast *(Bahri et al*., 2018). The use of baker's yeast can increase the nutritional content and can increase the storage time of feed ingredients (Malianti et al., 2019). Fermentation is a process that utilizes microbes with the aim of transforming the substrate into a specific product as expected (Iglesias et al., 2014). Fermentation is an effort to improve nutritional quality, reduce and even eliminate the influence of certain feed ingredients that can be done with the use of microorganisms (Surianti et al., 2020). Fermentation is a process that involves changing the substrate through physical or chemical mechanisms in both aerobic and anaerobic conditions that are influenced by the ezim produced by microbes. This process aims to increase nutritional value, improve texture and increase palatability as well as reduce anti-nutrient factors. (Malianti et al., 2019). Therefore, the use of baker's yeast is expected to decompose and increase the content of nutrition and shelf life so that its use is more optimal as a feed ingredient.

II. MATERIALS AND METHODS

Material

The research was carried out at the Feed Chemistry Laboratory, Faculty of Animal Husbandry, Marine and Fisheries, Nusa Cendana University from November to December 2023, starting from the collection of ingredients, fermentation and proximate analysis in the Laboratory. The material used is tofu amaps waste produced from a tofu factory located in Oesapa, Kelapa Lima Village, Kupang City and coconut pulp obtained from the rest of household processing and stalls in Kupang City and its surroundings

Method

Research Design

The research design uses a direct experimental method with 3 different fermentation times (t student test). The treatment consists of:

R1 = Tofu pulp waste and baker's yeast fermented coconut pulp waste (LATLAKF) with a fermentation period of 12 hours
R2 = Tofu pulp waste and baker's yeast fermented coconut pulp waste (LATLAKF) with a fermentation period of 24 hours
R3 = Tofu pulp waste and baker's yeast fermented coconut pulp waste (LATLAKF) with a fermentation time of 48 hours

Research Procedure

Fermentation research procedure using baker's yeast based on fermentation procedures from Nguru et al., (2022). Fermentation stage of tofu pulp and coconut pulp waste

- ✓ Collection of tofu pulp and coconut pulp waste
- ✓ After collecting, tofu pulp and coconut pulp are dried in the sun until dry
- ✓ After drying, 500 grams of tofu pulp waste and 500 grams of coconut pulp waste are mixed with a baker's yeast solution.
- ✓ Baker's yeast solution is a mixture of 3grams of baker's yeast dissolved in 600ml of water.
- ✓ After the mixture is evenly distributed, the campran is put into a container and tightly closed.
- ✓ Fermentation is distinguished from 3 different time durations, namely 12 hours, 24 hours and 48 hours
- ✓ After that, the fermentation results were analyzed proximate at the Feed Chemistry Laboratory, Faculty of Animal Husbandry, Marine and Fisheries, Nusa Cendana University

Variables studied and data analysis

The variables studied in this study were changes in the nutritional content of tofu pulp waste and baker's yeast fermented coconut pulp waste through proximate analysis in the form of crude fat (LK), crude fiber (SK) and BETN. After obtaining the laboratory results, the data will be analyzed using a student test using the Microsoft excel application.

III. RESULTS AND DISCUSSION

Nutritional content of tofu pulp waste and fermented coconut pulp waste

The results of the proximate analysis gave different results on the duration of fermentation time of tofu pulp waste and coconut bagasse waste. Changes in the results of prosimmon analysis of fermented tofu pulp and coconut pulp waste are listed in Table 1

Table 1. Changes in the nutritional content of fermented tofu pulp and coconut pulp waste

Variabel Penelitian	K1 (12 jam) ± SD	K2 (24 jam) ± SD	K3 (48 jam) ± SD
LK	31.858 ± 1.07	33.27 ± 1.68	34.718 ± 2.34
SK	25.517 ± 1.26	23.3 ± 0.86	21.817 ± 1.18
BETN	21.879 ± 2.22	18.595 ± 0.68	14.787 ± 1.15

Description: * Results of prosimate analysis of the Feed Chemistry Laboratory, Faculty of Animal Husbandry, Marine and Fisheries, Nusa Cendana University, 2023.

** Treatment with real effect (P<0.05)

Crude Fat (LK)

The results of the analysis showed that tofu pulp waste and fermented coconut pulp waste with fermentation time duration had a real effect (P<0.05) on crude fat content. The increase in fat content of tofu pulp waste and fermented coconut pulp waste was 2.86% with a fermentation time duration of 48 hours, when compared to the fermentation time of 24 hours and 12 hours. The increase in fat content is affected by the duration of fermentation time. Where the length of fermentation time has a real effect on increasing fat content (Saputro et al., 2015). The increase in fat content during fermentation comes from the mass of microbial cells that grow and multiply (Budiman, 2014). The activity of bacteria during fermentation produces fatty acids that are high enough so that the fat content tends to increase (Pratiwi et al., 2015; Soeparno, 1998). Carbohydrates are converted into fatty acids during fermentation, which increases the fat content (Yuvita et al., 2021). The activity of bacteria during fermentation results in relatively high levels of fatty acids, leading to an increase in fat content (Karina et al., 2019; Arif, 2018). The increase in fat content occurs due to the degradation process of organic matter used by fat-forming bacteria (Kurniawan et al., 2016).

Coarse Fiber (SK)

The results of the analysis showed that tofu pulp waste and fermented coconut pulp waste with fermentation time duration had a real effect (P<0.05) on the crude fiber content. The reduction in crude fiber content of tofu bagasse waste and fermented coconut bagasse waste was 3.70% with a fermentation time duration of 48 hours, when compared to the fermentation time of 24 hours and 12 hours. Crude fiber decreases during fermentation because it involves an enzymatic reaction produced by microorganisms that are able to change the physical shape of the fermented materialsi (Nguru et al., 2022; Moede et al., 2017). The duration of fermentation time affects the decrease in crude fiber content because it gives microbes the opportunity to grow and degrade tofu pulp and coconut pulp waste. This is in line with Hastuti et al., (2011) who reported that the increase in fermentation time gives microbes the opportunity to grow so that they can degrade the fiber. The growth of microbes in degrading fiber during fermentation depends on the nutrients contained in the waste tofu and coconut pulp. Suryani et al., (2017) reported that microbial growth will be disrupted if the nutrients needed are reduced or eliminated, eventually affecting microbes in the process of degrading fiber. The growth pattern of microbes is initially slow (lag phase), because it tries to adapt to the environment, then grows quickly (phase), which is when food is abundant, then it will slow down and stationary (stationary phase), which occurs when the food condition in the substrate is depleted, then growth decreases and leads to death ("death phase"), which occurs when the nutrients in the substrate or medium needed by microbes have been exhausted (Hastuti et al., 2011; Fardiaz, 1992). Fermentation can reduce the crude fiber content and can increase crude protein levels proportionally. Fermentation using yeast can reduce the crude fiber content because it can produce cellulase enzymes. The decrease in crude fiber content occurs due to the activity of the cellulase enzyme contained in yeast (Nuraya et al., 2016). The cellulase enzyme functions to hydrolyze cellulose into glucose, so that the crude fiber content will decrease (Widiarso et al., 2020). The crude fiber content of fermentation media will undergo changes caused by the change of certain enzymes to indigestible ingredients, for example cellulose and hemicellulose into simple sugars.

Non-Nitrogen Extract Ingredients (BETN)

The results of the analysis showed that fermented pulp waste and coconut pulp waste with the duration of fermanation time had a real effect ($P<0.05$) on the content of non-nitrogen extract materials. Decrease in BETN content of 3.28% with a fermentation time duration of 48 hours, when compared to 24 hours and 12 hours fermentation time. Generally during the fermentation process, the content of BETN tends to decrease, because BETN is used by microbes as energy during its growth (Hastuti et al., 2011). Santi, (2018) also reported that microbes utilize BETN as a source of energy in growth. Alauddin et al., (2019) also reported that the decrease in BETN levels was due to microbes that used BETN as an energy source during the fermentation process. Microbes can digest easily degradable organic matter such as BETN (Wahyuddin et al., 2024). Carbohydrates are the main components found in BETN (Muwakhid et al., 2023). The activity of microorganisms during fermentation can digest organic matter that is easily degraded, such as carbohydrates used as an energy source by microorganisms (Wahyuddin et al., 2024). Microbial activity uses easily digestible carbohydrate energy sources (BETN) as a first step for growth and reproduction(Hastuti et al., 2011). Increased microbial activity in degrading substrates will affect the use of more energy and can reduce the content of BETN (Harahap et al., 2021). The decrease in the content of BETN from microorganisms during the fermentation process will cause a greater consumption of carbohydrates from feed ingredients (Amrullah et al., 2015). The decline in BETN is affected by the amount of energy required for microbial growth, and more BETN is consumed as microbes multiply (Amrullah et al., 2015).

IV. CONCLUSION

The conclusion of this study is

1. use baker's yeast as a fermentation medium for tofu pulp waste and coconut pulp waste and according to crude fiber and BETN but can increase crude fat.
2. The use of baker's yeast as a fermentation medium for tofu pulp and coconut pulp waste with a duration of 48 am has a real effect on the content of crude fiber, crude fat and BETN.
3. The use of tofu pulp waste and fermented coconut pulp in baker's yeast can optimize the nutritional content, so that it can be used as animal feed.

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