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Metabolizable energy and nitrogen retention of local chickens fed rations containing fermented catfish waste

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Abstract

The study aimed to determine the effect of fermented catfish waste (FCW) by microbes *Lactobacillus paracasei*, *Bacillus subtilis*, and *Saccharomyces cerevisiae* (LBS) in rations as a substitute for fish meal on metabolizable energy and nitrogen retention. The study used local chickens (super native chickens / SNC) aged 14 weeks, as many as 24 heads, kept for 14 days. The experimental design was completely randomized, with six treatments and four repeats. Ration treatment is R0 (Lower control ration, protein 15% and ME 2,750 kcal/kg, without the use of FCW); R1 (R0 contains 5% FCW); R2 (R0 contains 10% FCW); R3 (R0 contains 15% FCW); R4 (R0 contains 20% FCW); and RS (Upper control ration, protein 18% and ME 2,750 kcal/kg, without use of FCW). The results showed that using FCW by LBS microbes had a significant effect (P<0.05) on metabolizable energy and nitrogen retention. Using 10% FCW in the ration formula resulted in the highest metabolizable energy value and nitrogen retention in SNC.

Keywords: Fermented catfish waste; Metabolizable energy; Nitrogen retention; Super native chicken

1. Introduction

The content of feed nutrients is needed by the body of livestock, one of which is energy. Energy is used by chickens for basic living needs as well as production. The energy consumed will partly be digestible energy, and the rest will be discharged together in excreta. The energy consumed by chickens will be used for body tissue growth and production [1]. Energy calculations are critical to determine whether the rations given to livestock can meet their needs or not. Metabolizable energy is a method for assessing the energy content of rations. The factor that affects metabolizable energy is the digestibility of feed. The feed has a low digestibility, so much energy will be wasted through excreta [2]. The calculation carried out in measuring metabolizable energy is carried out using the method [3], where comparing the energy content contained in the ration with the energy content contained in excreta, the metabolizable energy value will be obtained after calculating the difference between ration energy and excreta energy.

In addition to the energy quality that must be considered in compiling poultry rations, the quality of protein in the ration should not be forgotten. The quality of ration protein can be measured by nitrogen retention, which measures nitrogen consumption, excreta nitrogen, and urine. Protein in feed is essential for the survival of livestock. Protein has a role in making up meat, about 16% [4]. Proteins comprise 16% nitrogen, and other elements such as phosphorus and sulfur are sometimes found [4]. Feed protein retention can be estimated from nitrogen retention in feed, and to convert protein to nitrogen, it should be divided by the number 6.25 [5]. Factors that affect the value of nitrogen retention include genetics, age, feed given, and not all protein consumed by livestock can be retention. Other factors that affect the value of nitrogen retention are feed consumption, protein consumption and quality of protein provided, crude fiber digestibility, livestock condition, and balance of nutrients in the ration [6]. Nitrogen retention is closely related to ration

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consumption. The value of nitrogen retention depends on the protein content in the ration. The nitrogen retained is in line with the protein content in the ration consumed by livestock [7]. The more nitrogen value in the body (absorbed), the less nitrogen is wasted in excreta [8]. Feed with low protein content will move faster to leave the digestive tract when compared to feed that contains high protein, which will drive more slowly to the digestive tract to get more time in the denaturation process of protein that has been consumed [9]. This nitrogen retention value is closely related to ration consumption. Increased ration consumption will result in high nitrogen retention with high protein content in the feed and increased growth. Nitrogen retention is measured by measuring nitrogen consumed by livestock and nitrogen released through excreta so that the amount of nitrogen that the livestock body can digest can be known.

Super native chicken (SNC) is a cross between local male chickens and female breeds [10]. SNC grows relatively faster than native chicken; the fat content in the meat is small and has a meat taste similar to native chicken [11]. SNCs have a uniform weight, a fast growth rate, and a low mortality rate, and they quickly adapt to the environment [12]. However, in small-scale maintenance, productivity is relatively low, growth is slow, and has incubation properties [13,14]. For this reason, efforts are needed to increase the use value of the feed provided, with the addition of fermented catfish waste in the feed formula.

The catfish fillet industry will always produce waste because, in general, only the meat is taken, while the fish's head, entrails, and fins are wasted. The catfish industry has about 67% waste [15]. The economic value of fish waste is deficient, but if it can be used, it will provide significant value [16]. The results of the analysis of Saraswanti Indo Genetech Laboratory, 2022, the nutrient content of catfish waste, crude protein 26.05%, crude fat 20.94%, crude fiber 2.21%, calcium 1.5%, phosphorus 7.2%, lysine 1.29%, methionine 0.40%, cystine 0.26%. The nutrient content of fish meal from analysis of the Non-Ruminant Poultry Nutrition Laboratory and Animal Feed Nutrition, Faculty of Animal Husbandry Unpad, 2022, crude protein 41.6%, crude fat 7.82%, crude fiber 0.91%, calcium 5.5%, phosphorus 2.73%, lysine 4.45%, methionine 1.26%, cystine 0.63%. This means catfish waste needs processing to increase nutrient content, especially amino and essential fatty acids. One of the processors is fermentation technology.

Fermentation is a cost-effective and easy process as a form of feed processing. The advantages of fermentation include preserving feed, reducing anti-nutritional substances in feed ingredients, being environmentally friendly, increasing the digestibility of feed ingredients, and improving the quality of origin ingredients [17]. During the fermentation process, protein compounds and peptides are degraded into amino acids that are easily absorbed by the body [18]. The fermentation process involves proteolytic enzymes produced by microbes [19]. Microbes *Lactobacillus paracasei,* Bacillus subtilis*, and Saccharomyces cerevisiae* (LBS) are proteolytic and lipolytic bacteria, which in the fermentation process, can increase amino acids and essential fatty acids [20,21,22].

The effect of feeding shrimp waste bioprocess products by three microbes *Bacillus licheniformis, Lactobacillus sp.,* and *Saccharomyces cerevisiae,* with a bioprocessing time of two days in local chickens showed metabolizable energy of 2,614 kcal/kg [23]. Bioprocessing shrimp waste through gradual fermentation by *Bacillus licheniformis* followed by *Lactobacillus sp,* and *Saccharomyces cerevisiae* produced the best nutrient concentrate with a protein digestibility value of 72.91% [24].

Research on fish waste silage has been conducted previously by [25], which tested fish waste silage with a level of 15% in the ration to have a good effect on ration consumption, weight gain, and carcass weight of broiler chickens. Furthermore, [26] reported a feeding rate of shrimp waste flour in broiler chicken rations of 100 grams/kg (10%), achieving the best nutrient digestibility and energy availability of 5,467 MJ g/kg, dry matter base. In addition, [3] has also conducted research on the effect of shrimp shell fermentation with *Bacillus licheniformis, Lactobacillus sp.,* and *Saccharomyces cerevisiae* as much as 10% in low-protein feed, resulting in the performance and efficiency of Sentul chicken feed.

Fish meal is a feed ingredient commonly used to compile poultry rations as a source of protein. The protein content of fish meal is relatively high and is composed of many essential amino acids that affect the growth of livestock cells and tissues. Fish meal is quite difficult to replace with other protein sources due to the high composition of amino acids, lysine, and methionine in fish meal. Until now, fishmeal used to prepare feed in Indonesia still relies on imports, causing the price of fish meal to be relatively expensive, thus impacting feed prices. One of the efforts that needs to be made is to find alternatives to reduce or replace the use of fish meal in the manufacture of poultry feed. In addition, protein sources are sought not to compete with food needs. One source of protein that can be used as a feed ingredient is catfish waste.

2. Materials and methods

2.1. Fermentation with LBS microbes (*L.paracasei, B.subtilis, and S.cerevisiae*)

The LBS microbial inoculum is made by fermenting catfish waste with pure cultures to multiply LBS microbes so that each microbe becomes accustomed to the catfish waste substrate. Further fermentation is carried out.

2.2. Fermented Patin Fish Waste (FCW)

Fermented Patin Fish Waste (FCW) is obtained after fermentation of catfish waste with LBS microbes for five days at a dose of 10%. After it is harvested, the fermented product is dried and ground into fermented catfish waste flour (FCW).

2.3. Ransum

Table 1 Metabolizable Energy Content and Nutrients of Research Feed Ingredients

Feed Ingredients	ME	CP	EE	CF	Ca	P	Lys	Meth
	(Kcal/kg)	………………………………. (%)……………………………….						
FCW*	2239	37.27	10.51	1.15	5.56	8.60	1.95	0.50
Yellow corn	3350	8.60	3.80	2.20	0.02	0.08	0.26	0.18
Soybean meal	2230	44.00	0.80	7.00	0.29	0.27	2.69	0.62
Fine bran	1630	10.80	5.81	10.80	0.11	0.19	0.64	0.24
Meat bone meal	2375	38.84	10.93	2.46	9.80	4.50	2.08	0.54
Bone meal	-	-	-	-	24.00	12.00	-	-
Stone flour	-	-	-	-	40.00	-	-	-
PrMEix	-	-	-	-	30.87	1.11	-	-

Source: Analysis of the Ruminant Animal Nutrition and Fodder ChMEistry Laboratory, Faculty of Animal Husbandry, Padjadjaran University (2023). FCW, fermented catfish waste.

Table 2 Trial Ration Formulation

Feed Ingredients	R0	R1	R2	R3	R4	RS
	……………………………%……………………………………….					
FCW*	0.00	5.00	10.00	15.00	20.00	0.00
Yellow corn	57.00	58.00	58.00	58.00	58.00	53.00
Soybean meal	8.00	6.00	5.00	3.50	1.50	14.00
Fine bran	23.00	21.00	20.50	19.50	18.00	18.00
Meat bone meal	10.,00	8.00	4.50	2.00	0.00	13.00
Bone meal	0.75	0.75	1.00	1.50	2.00	0.75
Stone flour	0.75	0.75	0.50	0.00	0.00	0.75
PrMEix	0.50	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100.	100	100

FCW, fermented catfish waste; R0, bottom control ration without FCW; R1, ration contains 5% FCW; R2, rations contain 10% FCW; R3, ration contains 15% FCW; R4, ration contains 20% FCW; RS, upper control ration without FCW.

The ration used is prepared based on the nutritional needs of the SNC chicken finisher period, namely crude protein 18-19%; crude fat 4-7%; crude fiber 3-5%; calcium 1-1.2%; phosphorus 0.35%; lysine 0.6%; methionine 0.8%; and ME

2,750 kcal/kg [27.28]. The treatment ration consisted of two kinds of controls, for control below R0 with a crude protein content of 15% and control over RS ration with a crude protein content of 18%, and the energy content of both control rations was made the same at 2,750 kcal / kg. The nutrient content and metabolizable energy of the feed ingredients used are shown in Table 1, the formulation of the treatment ration is shown in Table 2, and the nutrient content and metabolizable energy of the treatment ration in Table 3.

Table 3 Metabolizable Energy and Nutrients Content of Experimental Rations

Ration	Metabolizable Energy and Nutrient Content								
	CP	**EE**	**CF**	**Ca**	**P**	**Lys**	**Meth**	**Sys**	**ME**
	……………………………………………%……………………………………………………								**k.cal/kg**
R0	15.07	5.19	4.20	1.09	0.53	1.10	0.49	0.30	2750
R1	15.09	5.27	3.92	1.25	0.90	1.04	0.47	0.29	2763
R2	15.00	5.39	3.83	1.37	1.18	0.94	0.44	0.29	2748
R3	15.06	5.50	3.67	1.59	1.45	0.88	0.42	0.29	2742
R4	15.09	5.59	3.43	1.95	1.82	0.81	0.41	0.29	2746
RS	18.07	5.61	3.96	1.26	0.62	1.37	0.54	0.33	2751

R0, R0, bottom control ration without FCW; R1, ration contains 5% FCW; R2, rations contain 10% FCW; R3, ration has 15% FCW; R4, ration contains 20% FCW; RS, upper control ration without FCW.

2.4. Super native chicken

The Super Kampung Chickens (SNC) were 14 weeks old, totaling 24 heads. The battery cage is 30 cm x 30 cm x 35 cm, which is as many as 24 units.

2.5. Sampling Procedure

The method of taking excreta is by first satisfying and then collecting excreta. SNC chickens are satisfied for 24 hours to MEpty the previous feed from the gastrointestinal tract. Furthermore, chickens are given feed according to the treatment of 100 grams. Drinking water is given ad *libitum.* The collection of excreta is carried out for 24 hours. Excreta is sprayed every 3 hours with a 5% solution of borax acid to avoid evaporation of nitrogen. The excreta is cleaned of adhering feathers and further weighed. The laboratory analyzed the excreta samples for gross energy and nitrogen content.

2.6. Observed Modifiers

The variables observed in this study were the value of Apparent Metabolizable Energy (AME), Apparent Metabolizable Energy nitrogen-corrected (AMEn), and nitrogen retention.

2.6.1. Apparent Metabolizable Energy (ME)

Apparent metabolizable energy (AME) takes the equation [3]

$$\text{AME (kcal/kg)} = \frac{[(Gross\ energy\ ration\ x\ amount\ ration\ consumption)-(Gross\ energy\ eksreta\ x\ amounteksreta)]}{mount\ ration\ consumption}$$

2.6.2. Metabolizable energy (AMEn)

Metabolizable energy is calculated by method [3] with the following formula:

$$\text{AMEn:} = \frac{(\text{Ebr x K}) - (\text{Je x Ebe}) - \left\{\frac{\text{K X Nr}}{100}\right\} - \left\{\frac{\text{Je x Ne}}{100}\right\} \text{x } 8{,}22}{\text{K}}$$

Information:
AMEn: Metabolizable energy corrected by nitrogen retention (kcal/kg)
Ebr: Gross Energy Ration (kcal/kg)
K: Number of Rations Consumed (kg)

Je: Amount of Excreta (kg)
Ebe: Gross Energy of Excreta (kcal/kg)
Nr: Nitrogen Ration (%)
Ne : Excreta Nitrogen(%)
8.22: constant value of metabolizable energy retained

2.6.3. Nitrogen Retention

The determination of nitrogen retention value is calculated by method [21] with the following formula:

$$RN(\%) = \frac{NI - NF}{NI} X\ 100\%$$

Information:
NI: Nitrogen Consumption (g)
NF: Excreta Nitrogen (g)

2.7. Trial Plan and Statistical Analysis

The study was conducted using an experimental method using a Complete Randomized Design with six treatments. Each test was repeated four times, resulting in 24 experimental units. The treatment given is in the form of the level of use of Fermented Patin Fish Waste (FCW) in the ration. The differences between treatments were tested using the Duncan Multiple Region Test.

3. Results and Discussion

3.1. Apparent Metabolizable Energy rations contain FCW

Data from research on using fermented catfish waste in rations against Apparent Metabolizable Energy energy in SNC are presented in Table 4.

Table 4 Apparent Metabolizable Energy Energy Value of Rations on SNC

Deuteronomy	**Treatment**					
	R0	**R1**	**R2**	**R3**	**R4**	**RS**
	………………………………kcal/kg……………………………………					
1	2728	2666	2931	2739	2634	2739
2	2821	2691	2979	2809	2683	2763
3	2746	2598	2994	2832	2740	2852
4	2709	2696	2885	2743	2605	2793
Total	11005	10652	11792	11124	10664	11149
Average	2751[b] ± 48.97	2663[a] ± 45.22	**2948[c]** ± 49.70	2781[b] ± 46.91	2666[a] ± 58.94	2787[b] ± 48.90

R0, bottom control ration without FCW; R1, ration contains 5% FCW; R2, rations contain 10% FCW; R3, ration contains 15% FCW; R4, ration contains 20% FCW; RS, upper control ration without FCW.

Based on Table 4, the average value of apparent metabolizable energy in SNC ranges from 2,663 kcal/kg to 2,948 kcal/kg. The highest apparent metabolizable energy value was obtained from chickens treated with R2 (2,948 kcal/kg). This was followed by RS (2,787 kcal/kg), followed by chickens treated with R3 (2,781 kcal/kg). Furthermore, R0 was a lower control with an apparent metabolizable energy of 2,751 kcal / kg, followed by R4, and R1 with an apparent metabolizable energy produced of 2,666 kcal / kg and 2,663 kcal / kg.

The results of Duncan's test analysis showed that R2 treatment was significantly different ($P<0.05$) against all treatments. The most excellent metabolizable energy value was produced by rations with R2 treatment (rations added 10% FCW), followed by RS as upper control, R3, R0 as lower control, R4, and R1. R1 and R4 are not markedly different

(P>0.05). The treatment of R3, R0, and RS was not significantly different (P>0.05) but markedly different (P<0.05) from the treatment of R1 and R4. This shows that using FCW can increase the apparent metabolizable energy in SNC. This increase in Apparent Metabolizable Energy energy value is due to LBS microbes in the ration. Fermented products containing LBS microbes can have a positive impact because of the activity of microorganisms that can increase the absorption of nutrients in poultry's digestive tract. This is because LBS can complex compounds of proteins and fats into simpler amino acids and fatty acids by the opinion [24] that *Saccharomyces cerevisiae* is a yeast that produces amylase enzymes, lipases, proteases, and other enzymes that can decompose food substances in the digestive organs. Similarly, research conducted by [29] shows that fermentation of fish waste with Bacilus subtilis bacteria can increase the content of nutrients, including amino acids. In addition, processing feed can improve feed quality, causing high digestibility value and affecting the increase in metabolizable energy value [30,31]. A low digestibility value causes a lot of energy to be wasted through excreta, and vice versa; if digestibility is high, then less energy is wasted through excreta, in line with [32], stating that the less energy released through excreta, the more energy in the ration is absorbed or digested by the body so that it is efficient in the use of ration energy.

The metabolizable energy of feed can be increased or improved by processing the feed first [33]. One way is by fermenting. Fermentation is the processing of products with the help of microorganisms to produce new products with enzymes produced by microorganisms to transform complex compounds into simpler ones [34]. *L. paracasei* is a gram-positive bacterium that can produce prolidase, dipeptidase, esterase, and aminopeptidase *and can produce lactic acid so that it can suppress the development of gram-negative bacteria such as E.coli* [20, 35]. According to [36], the decrease in the population of pathogenic bacteria in the digestive tract has a positive impact on increasing the metabolizable energy of chickens due to reducing competition between the host and pathogenic bacteria in utilizing energy from the feed consumed. Based on [21], *Bacillus subtilis* bacteria can produce protease enzymes, carboxy peptidases, and lipases to catalyze fatty acid hydrolysis. *Saccharomyces cerevisiae* is a potential unicellular and amylase-producing microbe capable of remodeling starch [37]. According to [38,39], the enzymes produced by Saccharomyces cerevisiae *include proteases, amylase, glucosidase, and other enzymes that can facilitate the absorption of nutrients in digestion.*

The results showed that the highest apparent metabolizable energy in SNC was fermented catfish waste with R2 treatment (Ration with FCW 10%; PK 15%), which is 2,948 kcal/kg. When compared to research [26], the level of feeding shrimp waste flour in broiler chicken rations as much as 100 grams/kg (10%) achieved the best energy availability of 5,467 MJ / kg or 1,305.77 kcal / kg dry matter base. In addition, results that are not too far shown from research [24] shrimp waste bioprocessing through gradual fermentation by *Bacillus licheniformis* followed *by Lactobacillus sp*, and *Saccharomyces cerevisiae* produced the best nutritional concentrate with a metabolizable energy value of free-range chicken 2,614 kcal / kg. At the same time, the research of Abun et al. (2016), the effect of giving shrimp waste bioprocess products by three microbes *Bacillus licheniformis, Lactobacillus sp., Saccharomyces cerevisiae* with a bioprocessing time of two days in local chickens showed metabolizable energy of 2,613.90 kcal/kg. Furthermore, [3] reported the effect of shrimp shell fermentation with *Bacillus licheniformis, Lactobacillus sp., and Saccharomyces cerevisiae* as much as 10% in low-protein feed resulted in the performance and efficiency of Sentul chicken feed. According to [40], the use of shrimp shell fermentation with microbes *Bacillus licheniformis, Lactobacillus sp*., and *Saccharomyces cerevisiae* at a level of 10-15% can support the growth phase in Sentul chickens. In addition, research [41] also recommends adding fish waste silage with a concentration of 10% of the total feed given, which can improve performance in intensive maintenance and save production costs in broiler chicken feed.

Fermentation of organic matter can release amino acid compounds and saccharides in the form of dissolved compounds so that they can be easily digested and absorbed optimally in the digestive tract of poultry [41]. In addition, fermented feed increases the content of vitamins such as riboflavin, provitamin A, and vitamin B12, which influence poultry growth [41]. The administration of 10% in R2 treatment with a crude protein ration of 15% is the most optimal administration of metabolizable energy in SNC, equivalent to upper control RS with a crude protein ration of 18%.

3.2. Nitrogen-corrected metabolizable energy rations containing FCW

Research data on the provision of fermented catfish waste in rations to nitrogen-corrected metabolizable energy in SNC are presented in Table 5.

Based on Table 5, the average value of nitrogen-corrected metabolizable energy (MEn) in SNC ranges from 2,519 kcal/kg to 2,792 kcal/kg. The highest MEn values were obtained from chickens that received R2 treatment on average (2,792 kcal / kg). This was followed by control over RS (2,635 kcal/kg), followed again by chickens treated with R3 (2,634 kcal/kg). Furthermore, R0 was the bottom control with MEn of 2,599 kcal / kg, followed by R1 and R4 with an average MEn produced 2,525 kcal / kg and 2,519 kcal / kg. Furthermore, the data was analyzed using fingerprint analysis to determine the effect of the treatment given. Based on Duncan's test analysis, R2 treatment was significantly different

(P<0.05) against all treatments. The most significant MEn value was produced with R2 treatment (rations added 10% FCW), followed by RS as upper control, R3, R0 as lower control, R1, and R4. R1 and R4 are not markedly different (P>0.05). The R3, R0, and RS treatments were not substantially different (P>0.05) but markedly different (P<0.05) compared to the R1 and R4 treatments. Based on [7], digestibility is a factor that affects the metabolizable energy of feed, and a lot of energy is lost through excreta if the digestibility of the feed is low. According to [3], MEn values are strongly influenced by energy consumption and feed protein, protein quality, nitrogen consumption, and nutrient balance in feed. According to [42], if the quality of protein is low or one of the amino acids in feed is deficient, then the nitrogen retention value will be low.

Table 5 Nitrogen-Corrected Apparent Metabolizable Energy Energy Value of Ration Nitrogen on SNC

Deuteronomy	**Treatment**					
	R0	**R1**	**R0**	**R3**	**R0**	**RS**
	…………………………………k.cal/kg……………………………					
1	2577	2526	2776	2595	2488	2588
2	2664	2550	2821	2660	2537	2612
3	2593	2467	2835	2683	2588	2698
4	2561	2556	2735	2598	2462	2642
Total	10397	10100	11169	10536	10077	10541
Average	2599^{b} ± 45.56	2525^{a} ± 40.90	**2792^{c}** ± 45.58	2634^{b} ± 44.14	2519^{a} ± 55.58	2635^{b} ± 47.64

R0, bottom control ration without FCW; R1, ration contains 5% FCW; R2, rations contain 10% FCW; R3, ration contains 15% FCW; R4, ration contains 20% FCW; RS, upper control ration without FCW.

The calculation of the MEn value is fundamental because the calculation of feed metabolizable energy without nitrogen correction is considered less able to represent the energy value of a feed. Following [43]), the importance of MEn calculation is significant because metabolizable energy alone cannot predict the energy value of a feed due to nitrogen stored in body tissues when catabolized; the result will be expressed as energy lost as urine. Therefore, in the calculation of MEn, energy is no longer affected by nitrogen.

3.3. Nitrogen Retention of Super Native Chickens Rationed with FCW

Data from research on using FCW in rations against SNC nitrogen retention are presented in Table 6.

Table 6 Nitrogen Retention Value of Super Native Chicken given Ration Containing FCW

Deuteronomy	**Treatment**					
	R0	**R1**	**R0**	**R3**	**R0**	**RS**
	……………………………%…………………………….					
1	70.317	63.700	68.665	65.104	65.653	68.100
2	73.157	63.661	69.735	67.244	65.759	67.950
3	71.812	59.392	70.362	67.463	68.080	69.356
4	69.269	63.341	66.149	65.246	64.229	67.788
Total	284.555	250.094	274.,911	265.056	263.720	273.,194
Average	71.13^{b} ± 1.703	62.523^{a} ± 2.094	**68.728^{b}** ± 1.857	66.264^{b} ± 1.262	65.930^{b} ± 1.594	68.299^{b} ± 0.716

R0, bottom control ration without FCW; R1, ration contains 5% FCW; R2, rations contain 10% FCW; R3, ration contains 15% FCW; R4, ration contains 20% FCW; RS, upper control ration without FCW.

Table 6 shows the average value of ration nitrogen retention, which ranges from 62.523% to 71.13%. Furthermore, the data was analyzed using a variety of analyses to determine the effect of the treatment given. The fingerprint analysis results show a significant value (P<0.05) or impact on the nitrogen retention value. Then, the Duncan test will be used to determine the difference between treatments. Based on Duncan's multiple distance test, the nitrogen retention values treated with differences in FCW on SNC, R2 (10% FCW and 15% CP), R3 (15% FCW and 15% CP), R4 (20% FCW and 15% CP), R0 (Control below 15% CP), and RS (Control over 18% CP), with R1 (5% FCW and 15% CP) the results were significantly different (P < 0.05). But in rations, R2 (10% FCW and 15% CP), R3 (15% FCW and 15% CP), and R4 (20% FCW and 15% CP), compared with R0 (Control below 15% CP), and RS (Control over 18% CP) did not differ markedly (P > 0.05).

Nitrogen retention is a method to show the amount of nitrogen the livestock body can absorb by measuring nitrogen consumed with feed and nitrogen released in the form of excreta [44]. Adding FCW in the ration at 10% to 20% gives the same results as control below R0 and control over RS. This means that the addition of FCW at 10% to 20% in the ration can still be utilized by SNC to achieve optimal nitrogen retention.

The effect that is not significantly different is thought to be because the SNC finisher period can only utilize the protein contained in the ration as much as 15% for his life needs, or 15% crude protein is sufficient for his life needs. This aligns with [10] ration at SNC age 12 weeks, namely with a crude protein range of 14.4% - 17.5% with metabolizable energy of 2,400-2600 kcal / kg. According to [45], lactic acid bacteria can cause pH conditions in the poultry's digestive tract to decrease to suppress the growth of pathogenic bacteria. Furthermore, [46] states that a decrease in pH can also cause proteolysis activity, resulting in increased protein absorption. That is why rations with 18% protein yield are the same as rations with 15% protein content when viewed from nitrogen retention. However, the R1 treatment with rations containing 15% CP and ME 2750 kcal/kg was significantly smaller (P<0.05) than all treatments because the enzymes produced by microbes in the 5% FCW ration have not been able to optimize the degradation of organic matter in the digestive tract so that nutrient absorption is not optimal. Based on [41], the addition of fish waste silage at the levels of 2.5%, 5%, and 7.5% does not affect the protein content of meat (P>0.05).

When categorized, nitrogen retention values are divided into three levels. Namely, high-quality nitrogen retention values are 70% and above, medium-range nitrogen retention values are 60-70%, and low range nitrogen retention values are 50-60% (Reid, 1973). The study results were numerical; all treatments included the medium range except R0 (lower control), which entered the high range. According to [47], the value of nitrogen retention is strongly influenced by ration consumption, protein consumption, and protein quality. Nitrogen consumption with directly proportional nitrogen retention and retained nitrogen in the body indicates the efficiency of protein use in SNC. According to [48], Positive protein retention means that the chicken's body will gain weight, and muscle or meat weaving will be formed. The higher the nitrogen retention value, the more nitrogen is left behind in growing livestock, so less protein is wasted on excreta.

4. Conclusion

The use of fermentation catfish waste affects metabolizable energy, nitrogen-corrected metabolizable energy, and nitrogen retention in Super Native Chicken. Using fermented catfish waste in rations at 10% resulted in the highest metabolizable energy of 2,948 kcal/kg with nitrogen retention of 68.72%.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest is to be disclosed.

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