International Journal of Recycling of Organic Waste in Agriculture
Doi: 10.30486/IJROWA.2023.1951215.1411

ORIGINAL RESEARCH

Proximate analysis of animal feed from organic waste and effect on changes in body weight *Gallus domesticus*

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Received: 31 January 2022 / Accepted: 29 May 2023 / Published online: 30 May 2023

Abstract

Purpose: The purpose of the study was to find that solid waste from sago, tofu, and rice could be made into animal feed with high nutritional content as evidenced by increasing body weight of *Gallus domesticus.*

Method: This research is a quantitative research using laboratory and field experimental methods to examine the proximate feed and the reaction of experimental animals during feeding. The proximate profile of feed was determined using indicators (protein, carbohydrate, fat, calcium, vitamin B-12, carotene/vitamin A content, ash content, and water content), and the experimental animals' response to feeding was determined using time indicators. The reaction of experimental animals to feed was determined using a stopwatch, as shown by the amount of time spent feeding.

Results: The results showed that each type of feed had a different proximate profile, with the highest levels of protein, fat, ash, and water found in animal feed made from tofu waste; levels of calcium, vitamin B-12, and vitamin A content are found in animal feed made from a combination of tofu dregs and sago dregs. The highest carbohydrate content was observed in animal feed made from sago dregs. The results of the one-way ANOVA test showed that there was a difference in body weight gain and FCR of *Gallus domesticus* after being given feed from organic waste, where the best feed was made from tofu waste.

Conclusion: Each type of organic waste feed has a different proximate profile, where *Gallus domesticus* responds very well to all feeds, and has an effect on chicken body weight.

Keywords: Feed nutrition, Sago, Soybean, Rice, Growth

Introduction

Recent industrial advances have made a substantial contribution to Indonesia's economy. On the other hand, industrial waste and the increasingly intensive exploitation of resources in industrial development have an influence on the environment. A transformation of the contextual framework in industrial management is required, namely the belief that industrial operations as a whole must ensure that the natural environmental system functions appropriately within the boundaries of the local ecosystem to the biosphere. Material and energy efficiency in use, processing, and recycling will result in economic advantages and benefits while also saving the environment (Lamma 2021; Mwanza 2021).

One approach for environmental conservation is to use garbage as a primary material in the creation of a

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product. Tofu dregs are an example of trash that may be used as raw material since they have chemical qualities that are dominated by protein and can be processed into products that function as protein sources (Olivera et al. 2016; Amaha et al. 2016). Another example is bran and sago dregs, which include macronutrients in the form of carbs and are beneficial to animals (Ch'ng et al. 2014; Silva et al. 2014; Irwanyah and Junaidi 2019). Processing soybeans to make tofu, sago pith to make sago starch, and grains to make rice all have positive and bad effects on the community. The beneficial consequences of these activities include the provision of protein and carbs to the community as well as the generation of income for the community. These operations have a negative influence on the environment since they generate garbage such as tofu dregs, sago waste, and bran. Because waste from tofu, sago, and rice industries contains nutrients such as protein, carbs, fat, calcium, phosphate, iron, and Vitamin B-12, and Vitamin A, it can become a new source of income for the community (Tian et al. 2012; Faizal et al. 2016; Febrianti et al. 2017). The nutritional value of tofu, sago, and bran dregs can be used to create animal feed, primarily poultry feed (Sugiura et al. 2009; Adeni et al. 2010). Fermented sago waste can be used as chicken feed. Witariadi et al. (2016) reported a rise in body weight of broiler hens fed fermented tofu dregs feed with probiotic inoculum. Rasyid et al. (2020), also found that fermented sago waste can be used as animal feed for ruminants, particularly cows.

Since they are high in carbohydrates, protein, and fat, tofu dregs, sago, and bran can be used as animal feed. The nutritional value of tofu pulp was found to be 8.66% protein, 3.79% fat, 51.63% water, and 1.21% ash, indicating that it has the potential to be turned into animal feed ingredients. Animal feed is composed entirely of substances that are readily available, useful to cattle, and do not cause harm to the livestock's health. The feed must be of superior quality. It provides nutrients that the cattle body requires for survival, including water, carbs, fat, and protein. Feed is a critical product for cattle. Sufficient quality and quantity of feed is required to sustain animal growth and productivity. Feed is critical to the success of a livestock operation. Around 80% of the total productivity of cattle is spent for feed costs (Ahmed et al. 2013; Popoola et al. 2019). As a result, a solution is required to produce feed using relatively inexpensive and abundant basic materials.

Numerous researchers have explored animal feed made from tofu, sago, and bran waste, but the research is currently ongoing. There has been no research or development of an animal feed derived from a combination of two forms of waste: tofu dregs and sago or tofu and bran. By combining the two forms of garbage, the three organic waste types have a varied nutritional content. The nutritional value of the feed generated is supposed to be complimentary (Ubwa et al. 2014).

Tofu pulp contains a higher proportion of protein (17.4%/100 g material) than tofu (7.8%/100 g material). Apart from that, tofu dregs are a good source of carbs, lipids, minerals, phosphorus, iron, and vitamin B1. As is the case with tofu dregs, sago and bran dregs, contain carbs, protein, fat, calcium, iron, and terminal fructose. Due to the high nutrient content of both types of waste, they are ideal for incorporation into raw materials used in the manufacture of animal feed (Kim and Lee 2010; Nugroho et al. 2019).

The nutritional diversity of tofu, sago, and bran provides a tremendous possibility for integration and development into products such as animal feed, particularly for poultry. Historically, chicken feed has been primarily composed of maize or concentrate, which is relatively expensive. The difference between researchers' animal feed and existing feed is that the raw materials used are organic, inexpensive, and even abundant in nature. They are also safe for the environment because they are free of chemical additives, safe for livestock, and contain the nutrients required for livestock growth.

Materials and method

This research is a qualitative and quantitative research using laboratory and field experimental methods to examine the proximate feed and the reaction of experimental animals during feeding.

The proximate profile of feed was determined using indicators (protein, carbohydrate, fat, calcium, vitamin B-12, carotene/vitamin A content, ash content, and water content), and the experimental animals' response to feeding was determined using time indicators. The reaction of experimental animals to feed was determined using a stopwatch, as shown by the amount of time spent feeding.

The following equipment was used throughout the study: destruction tube, destruction devices, distillation and titration tools, Soxhlet extraction apparatus, Soxhlet flask, Cimarec Stirring, and Hot Plates, beakers, analytical scale, drop pipette, measuring pipette, micropipette, suction rubber, vacuum pump, measuring cup, measuring flask, magnetic stirrer, glass funnel, stirrer, 80 mesh sieve, UV-Vis spectrophotometer, clamps, oven and desiccator.

The following materials were used in the study: sago pulp, sago waste, bran, 1% starch solution, water, 730 ppm sodium bisulfite solution, n-hexane, 0.085N HCl solution, methyl red indicator, a mixture of $K_2SO_4$and HgO, 45% NaOH solution, H_3BO_3 2% solution, distilled water, concentrated H_2SO_4 solution, 5% phenol solution, glucose solids, 52% $HClO_4$ solution, aluminum foil, sterile plastic, and *Gallus domesticus*. The steps in this study are as follows:

Making animal feed from organic waste

The procedure for making animal feed from organic waste in the form of tofu dregs, sago waste, and bran are: (a). Prepare instruments and materials for use during the research; (b). Clean tofu and sago waste with running water and then drain it into the given container; (c). Dry waste in the sun for two consecutive 24 hour periods (sunny conditions); (d). After crushing the dry waste with a mortar and pestle, it was sieved using a 50 mess sieve size; (e). Using a 1% starch solution, the flour was then combined and bonded; (f). Proceed with the development of feed with a length of 0.5 cm; and (g). Dry the feed for 2 x 24 hours (sunny conditions).

Analysis of carbohydrate levels

The approach adopted by (Osman et al. 2019) for sample analysis was as follows: 1 gram of unsulfured mango seed flour was weighed and stirred in 10 ml distilled water. The solution was added with 13 ml of 52% per chloric acid ($HClO_4$) and mixed for 20 minutes using a magnetic stirrer and aluminum foil to cover the beaker. A 250 ml measuring flask was filled half way with distilled water and filtered. Another 250 ml measuring flask was filled to the brim with distilled water. The sulfurized mango seed flour process was performed a second time for carbohydrate content quantification. Standard glucose solutions with concentrations of (0, 20, 40 and 60, 80 and 90 ppm) were prepared. Each solution should be 1 ml. The solution was shaken in 1 ml of the phenol solution at a concentration of 5% and added with 5 ml of concentrated sulfuric acid solution immediately, immersed in water, and let aside for 10 minutes. The absorbance was measured at a wavelength of 490 nm. The standard curve was created.

The standard glucose solution was replaced with the sample and the procedure was repeated (Ahmed et al. 2013; Arwinsyah et al. 2018).

Fat content analysis

The fat content was determined using the Soxhlet extraction method (Choe et al. 2017), which included drying the pumpkin in an oven of the appropriate size for the Soxhlet extraction apparatus. Following that, the item was chilled in a desiccator and weighed. Two grams of the unsulfured sample were weighed and wrapped in cotton and filter paper. The sample was placed in the Soxhlet extractor, followed by the condenser and the flask. The sample in the flask was added with an adequate amount of n-hexane. Reflux the solvent until it returns to the flask and the results are clear. Heat the flask until the solvent boils and evaporates up into the filter paper-wrapped sample all the way to the flask, reducing the solvent in the flask. Heat the flask containing the extracted fat to 105 ^{0}C in the oven, cool it in a desiccator, and then weigh it until the weight is retained. The procedure was done twice for sulfurized mango seed flour. The following formula is used to determine the fat content (Schneides et al. 1951).

Analysis of protein levels

The protein content was determined using the micro-Kjeldahl method (Adejumo et al. 2016), which entails the following: 0.5 grams of unsulfured mango seed flour were weighed and placed in a destruction tube. 1 gram of the K_2SO_4/HgO combination and 10 ml of concentrated H_2SO_4 solution were added to the tube. All of the components were digested in the deconstruction tube until the liquid boiled and the ingredients dissolved completely. Then, the heat was turned off and let cool. The distillation procedure was conducted, followed by the titration against the distillate. Titration was halted when the distillate turned crimson. A blank solution was made by substituting distilled water for the sample. As with the selection, digestion, distillation, and titration were carried out.

Calcium content analysis

Calcium content was determined by weighing 5 grams of animal feed samples ash and dissolving it in 15 ml of HCl: H_2O. (1:4). The solution was placed in a beaker glass and the water evaporated until it reached boiling point using a water bath, at which point it was filtered via filter paper. A 100 ml volumetric flask was used for filtration. After collecting the filtration solution, it was diluted to the specified concentration. Ten milliliters of the test sample was placed in a 250 milliliter Erlenmeyer flask and diluted with a buffer solution to a pH of 10. Prior to titration with 0.01 M Na_2-EDTA, the solution was tinted pink with the murex ide indicator. Following that, the color was titrated until it shifted from pink to purple. The volume of the Na_2-EDTA standard solution used in the titration was recorded (Faizal 2017).

Analysis of beta-carotene content

B- carotene analysis procedure on the test sample as follows (Tasie and Gebreyes 2020): (a). Prepare the tools and materials to be used, then thoroughly clean them to ensure that no contamination from other undesirable items affects the final product; (b). Weigh the purified sample up to ten grams in Erlenmeyer; (c). Incorporate 50 ml of 10% KOH alcohol; (d). In a water bath, heat the substances that have been combined with 10% KOH alcohol for 30 minutes; (e). After 30 minutes, add hot alcohol; (f). Cool the sample on the Erlenmeyer with running water from outside the sample until it no longer feels hot on the inside, then filter the filtrate using filter paper, taking care not to screen any sample residue into the filtrate; (g). Then add 50 ml of ether (2x washing) to the sample residue and shake the Erlenmeyer tube again; (h). Stuff the nut flask with the filtered filtrate; (i). Remove the green solution until only the yellow solution remains; (j). To the filtered yellow solution, add 15 ml ether and then 50 ml distilled water; (k). Repeat the filtering/draining procedure until only a clear yellow color remains; (l). Using a wavelength of 436 nm, determine the color created on the spectrophotometer; (m). Prepare a standard solution by diluting 1 ml of pure carotene solution in methanol to the limit mark and homogenizing it; and (n). Using a spectrophotometer set to 436 nm, determine the absorbance value of the solution.

Analysis of cyanocobalamin content (vit-B12)

The initial step begins with determining the maximum wavelength of vitamin B-12, which is 361 nm. After that, it is continued by making a calibration curve that produces a calibration equation. The next step is to weigh 100 mg of animal feed and dissolve it with aquadest in a 500 ml volumetric flask (sample solution). Pipette 25 ml of the sample solution, and dissolve it with aquadest in a 200 ml volumetric flask. The absorbance was measured by UV-Vis spectrophotometry at a wavelength of 361 nm using an aquadest blank. The absorbance results are substituted into the calibration equation to obtain data on vitamin B-12 levels in the tested sample (King et al. 2018).

Water content analysis

The procedure for analyzing the water content of the sample is as follows (Minh and Tram 2017): (a). The saucer was preheated in an oven to 105 ^{0}C; (b). A desiccator was used to chill the cup; (c). The empty weight of the saucer was weighed; (d). The ingredients were combined in a cup and then weighed to a maximum of 5 grams; (e). It was cooked for 3 hours in the oven; (f). It was cooled in a desiccator for 10 minutes; (g). The cup of ingredients was re-weighed; and (h). Re-insert into the oven until the weight was steady.

Ash content analysis

The procedure for analyzing the ash content of the sample is as follows (Minh and Tram 2017): (a). Heat a saucer in a kiln with a temperature of 750 ^{0}C; (b). The cup was cooled by placing it in a desiccator; (c). The ingredients were put into a cup, then weighed up to 5 grams; (d). Weigh the saucer; (e). The saucer was heated again into the furnace at 750 ^{0}C; (f). It was cooled in a desiccator for 10 minutes; (g). The cup of ingredients was re-weighed; and (h). Calculate the weight of the ash.

Poultry response to feed

The location of the study was to determine the response of experimental animals to the feed given at Mrs. Evi's chicken farm is located on Wara Street, Batu Merah Village, Ambon-Indonesia. The environmental conditions of the farm are very good with a temperature range of 29 ^{0}C-30 ^{0}C and humidity of 74%-80%. Observations on the response of *Gallus domesticus* to feed are as follows: (a). Ten *Gallus domesticus* were utilized for each type of feed, totaling 50 animals of uniform age, two weeks and weighed 380 g; (b). Each container was prepared with 10 g of feed to observe the experimental animals' response; (c). Using a stop-watch, determine the average speed of feed time out for each experimental animal according to the type of feed given; and (d). Along with assessing *Gallus domesticus*'s response to feed, this study fed 50 experimental ani-

mals divided into ten groups for each type of feed. *Gallus domesticus* was weighed after thirty days.
Data were collected in the form of proximate profiles of animal feed and animal responses in tabular and descriptive formats. Meanwhile, body weight gain data for *Gallus domesticus* were evaluated using the SPSS version 22 for Windows computer after thirty days of feeding.

Results and discussion

Feed proximate profile

The nutritional diversity of tofu, sago pulp, and bran presents a tremendous prospect for development into animal feed products. Historically, animal feed for *Gallus domesticus* has included a greater proportion of corn and concentrate, which is relatively expensive. As such, the purpose of this study was to ascertain the proximate profile of animal feed made from tofu, sago pulp, and bran waste, as indicated in Table 1.

Table 1 Proximate analysis on feed from organic waste

Feed proximate profile	Type of feed				
	A	B	C	D	E
Protein (g/100 g)	24.314	13.431	17.278	20.389	21.527
Carbohydrates (g/100 g)	34.554	50.994	46.721	53.241	34.198
Fat (g/100 g)	18.037	14.553	13.567	6.017	6.758
Calcium (mg/100 g)	20.634	32.318	28.079	1380.539	1970.841
Cyanocobalamin (µg/g)	21.757	58.898	25.913	68.085	142.200
Beta Caroten (SI/100 g)	27.27	140.748	96.452	502.609	700.546
Ash content (mg/100 g)	8.062	7.581	8.086	7.583	7.879
Water content (g/100 g)	14.535	13.442	14.300	12.772	12.541

A: Feed from tofu dregs; B: Feed from bran; C: Feed from tofu dregs + bran; D: Feed from sago dregs; E: Feed from tofu dregs + sago dregs

According to Table 1, the feed generated from tofu waste had the highest protein level (24.314 g/100 g), whereas the feed made from rice processing waste (bran) had the lowest protein content (13.431 g/100 g). The maximum carbohydrate concentration was 53.241 g/100 g in sago waste, while the lowest carbohydrate level was 34.198 g/100 g in tofu dregs and sago trash. The feed made from tofu dregs had the highest fat level (18.037 g/100 g), whereas sago waste had the lowest fat content (6.017 g/100 g). The feed created from a combination of tofu waste and sago waste had the maximum calcium level (1970.841 mg/100 g), while the feed made from tofu waste had the lowest calcium content (20.634 mg/100 g).

The highest cyanocobalamin content was 142.200 µg/g from a combination of tofu pulp and sago waste, and the lowest cyanocobalamin content (21.757 µg/g) was observed in feed from tofu pulp. The highest vitamin A content (700.546 SI/100 g) was observed in feed from a combination of tofu pulp and sago waste, and the lowest vitamin A content (27.27 SI/100 g) was found in feed made from tofu pulp. The highest ash content was 8.086 g/100 g, found in a combination of tofu pulp and bran, while the lowest ash content was 7.062 g/100 g, observed in feed made from tofu pulp. The highest water content (14.535 g/100 g) was found in feed from tofu waste, while the lowest ash content (12.541 g/100 g) was observed in feed made from a combination of tofu dregs and sago waste (Table 1).

The response of *Gallus domesticus* to feed

While it is difficult to get quality feed at a reasonable price on the market or livestock shops, breeders can obtain the feed by utilizing organic waste. The feed in question is made from organic waste, such as tofu waste (tofu dregs), sago processing waste (sago dregs), and rice processing debris (bran). Feed made from the three forms of waste must meet specific nutritional requirements for poultry experimental animals.

Table 2 summarizes *Gallus domesticus*'s feeding behavior.

Table 2 Experimental *Gallus domesticus* response to feed

Treatment	**Amount of Feed Given (g)**	**Average Runout Speed (second)**	**Enthusiasm**
A	10	30	+
B	10	33	+
C	10	27	+
D	10	25	+
E	10	27	+

+: Chicken finishes the feed given

Experimental *Gallus domesticus* responded positively to each type of meal served. The way chickens consumed 10 g of grain demonstrates their interest in food (Table 2). Each feeding occurred at 07.00 WIT (Eastern Indonesian Time), and continued for 30 days. Data in the Table 2 represent the average response time of chickens to feed consumption during a 30-day period employing 50 chickens (10 x 5 different types of feed) of uniform age, namely two weeks (380 g). Table 3 shows the body weight gain of *Gallus domesticus* following thirty days of feeding.

Table 3 *Gallus domesticus* body weight gain (BWG) after thirty days feeding

Type of feed	Group (head/g)										Total	Average
	1	2	3	4	5	6	7	8	9	10		
A	915	963	1050	975	957	910	1045	912	920	973	**9620**	**962**
B	842	893	951	878	917	869	946	853	893	917	**8959**	**895.9**
C	861	931	971	921	934	897	975	917	921	943	9271	927.1
D	850	912	952	915	920	895	959	859	913	932	9107	910.7
E	911	957	987	965	954	915	1050	915	917	1010	9581	958.1

According to Table 3, the 50 chickens used in the study gained various amounts of weight. *Gallus domesticus* had an initial body weight of 380 g (two weeks old) and increased weight after one month of feeding. Treatment A (feed from tofu dregs) resulted in the maximum body weight, while treatment B resulted in the lowest (feed from bran). The ANOVA test findings indicate that the type of organic waste feed has a substantial effect on the body weight of *Gallus domesticus*. As the sig. value was less than 0.05, it can be stated that feeding on organic waste has an effect on *Gallus domesticus* body weight gain. According to tukey's test, treatment B did not differ substantially from treatments D and C. Treatment D did not differ significantly from treatments C and E, and treatment C did not differ significantly from treatments E and A. Based on *Gallus domesticus*'s average body weight, it was determined that treatment A was the best of all treatments.

One measure of the productivity level of *Gallus domesticus* that can be used is FCR. FCR (Feed Conversion Ratio) is the amount of feed needed to produce 1 kg of chicken meat. The smaller FCR value, the better the productivity. This is because less feed is needed to produce 1 kg of *Gallus domesticus* meat. Total feed consumption for each treatment was 3000 g with FCR presented in below.

FCR of *Gallus domesticus* for each treatment aged 30 days as follows: feed A (0.312), B (0.335), C (0.323), D (0.329), and feed E (0.313). Based on the standard FCR Table, *Gallus domesticus* with an age range of 28-35 days have an FCR standard of 1.445 (Livingston et al. 2020). FCR *Gallus domesticus* for all types of feed treatment is lower than the FCR standard for broiler chickens. This means that *Gallus domesticus* requires a smaller amount of feed than the standard to produce 1 kg of chicken meat. Thus, the FCR *Gallus domesticus* is included in the good category and has a high level of productivity (Table 4).

Table 4 FCR *Gallus domesticus* after thirty days feeding

Type of feed	Total Feed Consumption (g)	Total Weight of Whole Chicken (g)	FCR	*Gallus domesticus* FCR standard (28-35 days) (Livingston et al. 2020)
A	3000	9620	0.312	
B	3000	8959	0.335	
C	3000	9271	0.324	**1.445**
D	3000	9107	0.329	
E	3000	9581	0.313	

Poultry, in general, requires adequate nutritional intake to grow (Choe et al. 2017). These nutrients can be found in the feed they consume or can be generated by their body. Feed is defined as any material that can be consumed, digested, absorbed, and utilized to meet the nutritional requirements of livestock. The results of this study indicated that organic waste-derived feed comprised a variety of proteins, carbs, lipids, vitamins, calcium, ash, and water. The nutritional value of the feed varies according to the raw materials used; for example, animal feed made from tofu waste contains a high concentration of protein, fat, and water, but animal feed made from sago waste contains a high concentration of carbohydrate and calcium. Animal feed made from tofu dregs and sago waste contains a high concentration of beta-carotene and cyanocobalamin (Goodman 2020).

Poultry select food based on their nutritional requirements even though they are provided with various distinct feeds (cafeteria). Additionally, birds rely more on sight to select food than ruminants do. Pellets, mush, crumble, cube, cake, and chips are all examples of feed (single ration) provided to animals. The brownish pellets used in this investigation were used to make the animal feed. The pellets were proven excellent as poultry feed. This is demonstrated by

Gallus domesticus's positive response in the form of feeding behavior. Besides, the time required to consume 10 grams of feed varied between 25 and 33 seconds/head. Each variety of feed required ten *Gallus domesticus*, bringing the total number of experimental animals to fifty. None of the experimental animals demonstrated a rejection reaction to the feed offered, which is consistent with Westendorf et al. (1996) 's perspective that a rejection reaction by livestock to feed is defined by the livestock's response to avoid or move away from the feed given.

Animal feed produced from tofu waste, sago waste, and bran offers several advantages over commercial poultry feed. The feed is made from inexpensive basic materials. Because it makes use of waste, raw resources become plentiful and organic, making it safe for animals and the environment (Irwansyah and Junaidi 2019; Adejuma et al. 2016; Truong et al. 2019). Additionally, the combination of protein-rich tofu waste and carbohydrate-rich sago waste can stimulate the growth and production of animal meat. Because the feed is unscented, it can be safely stored for an extended period. According to Khan et al. (2015), healthy animal feed is made from organic ingredients and is free of chemicals or chemical residues, making it safe for cattle and the environment. Animal feed that is safe for livestock and the environment will have an effect on the safety of livestock intake by humans, as chemical residues in animal feed are extremely detrimental to human health (Kaewkhao and Limsuwan 2012).

The ANOVA test revealed that the type of organic waste feed had an effect on the body weight of *Gallus domesticus*, with the best results coming from tofu waste feed. *Gallus domesticus* body weight changes due to the nutritional content of the meal, specifically protein, carbs, lipids, vitamins, and minerals. Each vitamin in animal feed has a distinct purpose. For example, protein is critical for chickens since it serves as a building substance that may heal damaged or shrinking tissue (breeding and tissue maintenance) and regenerate new tissue (growth and formation of protein). Protein can also be catabolized for energy or as a substrate for carbohydrate and fat tissue, and the body needs protein to build hormones, enzymes, and other critical biological molecules such as antibodies and hemoglobin (Olivera et al. 2016).

Carbohydrates are the third largest type of organic components found in the body of poultry, after protein and fat. Carbohydrates are required in monogastric animal feeds such as chicken and rabbits. Carbohydrates are frequently required in poultry feed as an inexpensive source of energy. Carbohydrates can help protein work more efficiently by reducing the amount of protein used as an energy source. Carbohydrates act as a binder or linker between food constituent particles, hence increasing the pellets' stability and durability. Additionally, carbs aid in enhancing the palatability (likability) of diet (Nugroho et al. 2019). Additionally, the fat content of feed is beneficial for livestock growth. Lipids are diverse chemical molecules present in plant and animal tissues. They are soluble in organic solvents but insoluble in water. Fats and oils are one class of substances that are critical in nutrition. Animals store fat in their bodies, while plants store oil in their tissues. Lipids can be used in place of protein, which is critical for growth, because triglycerides (fat and oil) can be transformed into free fatty acids to generate metabolic energy in poultry and monogastric muscles under certain conditions. Lipids can be beneficial as vitamins A, D, E, and K absorbents and transporters (Osman et al. 2019). Calcium is one mineral that poultry require. Minerals have a critical role in the construction of the skeleton (bones and teeth) and exoskeleton of birds. Additionally, minerals contribute to the maintenance of osmotic pressure and the regulation of changes in water and solution inside the poultry body, and they serve as a component of the structure of poultry soft tissues. Minerals are necessary for nerve impulse transmission and muscle contraction, are critical for maintaining the body's acid-base balance and the pH of blood and other body fluids, and are useful as components of numerous enzymes, vitamins, hormones, and respiratory pigments, or as cofactors in metabolism, catalysts, and enzyme activators. Calcium insufficiency or deficit can result in lower livestock development, poor feed efficiency, bone demineralization, skeletal deformation, aberrant calcification of the ribs and dorsal fins, and anorexia, among other adverse effects (Ubawa et al. 2014).

Vitamins are chemical compounds that are necessary for growth but are only required in trace amounts. Vitamin deficiency diseases are referred to as avitaminosis or hypovitaminosis. The majority of poultry vitamin requirements have been carefully established, particularly those vitamins that are not provided in appropriate quantities in the daily diet. Poultry are extremely vitamin deficient. This is because birds do not benefit from vitamin production in the digestive tract by microbes. Intestinal bacteria in poultry compete for these vitamins with their own "hosts." Poultry has a high vitamin need due to vitamins are required for key metabolic activities in the animal body. Due to the high density of modern poultry farming, the chickens are subjected to a variety of stresses, increasing their demand for vitamins. Vitamin B12 (cyanocobalamin) and vitamin A are required for poultry (carotenoid) (Akpabio and Ikpe 2013).

Vitamin B12 is involved in the production of nucleic acids, possibly by the conversion of ribose to deoxyribose and the formation of a methyl group on thiamine. Vitamin B12 insufficiency in chickens and other animals is characterized by slow development and reproductive failure with little or no anemia. Vitamin A is a dietary supplement factor that was initially isolated as a food component. Vitamin A's chemical characteristics are found in cattle products, particularly alcohol, specifically retinol. Livestock bodies are preserved in conjunction with fatty acids, particularly palmitic acid. Apart from the nutritious components in animal feed, the moisture content is critical for preventing the feed from deteriorating over its shelf life (Zotte et al. 2020).

Water is a critical component of a test sample. Although it is not a source of nutrients, its existence is critical for the continuation of living organisms' metabolic processes. Free water can contribute to the degradation of samples or test materials by microbiological, chemical, or enzymatic activities, as well as through the activity of harmful insects. Other kinds of water do not aid in the damage process, and so the water content is not an absolute measure that can be used to forecast the rate of degradation of a test material. In this case, the water content in question is water activity (Aw), which indicates the ability of water in biochemical processes that help damage the test material. It is critical to determine the moisture content of a sample or material being analyzed because it reveals the percentage of water contained in the sample or material being analyzed. Water content in the test sample has an effect on the storage time (Ahmed et al. 2013).

When a material's water content is high, it is easily damaged. Water content increases the moisture content of the sample or substance, and humid circumstances are more suitable for microorganisms such as bacteria or fungi. Bacteria and fungus thrive on organic matter-rich substrates and in humid environments. Animal feed made from organic materials is a great medium for microorganism development. Additionally, the diet has a large proportion of water. The results indicated that animal feed made from tofu waste had less water than other animal feeds. The drying factor contributes to the water content of the test sample. A thorough drying process will significantly reduce the amount of water retained in organic waste. The scorching sun, with a temperature of roughly 30 ^{0}C, will aid in the process of water evaporation. Prolonged drying accelerates the evaporation of water (Tiro et al. 2018; Goodman 2020; Adejumo et al. 2016).

Conclusion

Each type of organic waste feed has a unique proximate profile. Animal feed derived from tofu dregs contains the highest levels of protein, fat, ash, and water. In comparison, animal feed manufactured from a combination of tofu dregs and sago waste contains the highest concentrations of calcium, vitamin B-12, and vitamin A. The highest carbohydrate content is observed in sago waste-based animal feed *Gallus domesticus* responds extremely well to all feeds and organic waste feed has a substantial effect on the body weight of chickens.

Acknowledgment The author would like to thanks the Laboratory of Universitas Muhammadiyah Malang and Laboratory of MIPA IAIN Ambon who have provided labor and financial assistance during the research

Compliance with ethical standards

Conflict of interest The authors declare that there are no conflicts of interest associated with this study.

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