Liquid smoke supplementation in coconut water multinutrient block to nutrient consumption of Quail

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Abstract. This study aims to determine the effect of Liquid Smoke Addition in Coconut Water Multinutrient Block (CWMB) to quail on the nutrient consumption such as crude protein, crude fiber, crude fat and nitrogen-free extract. The treatments consisted of T0: control AkMB ration without liquid smoke addition; T1: CWMB ration with 0.25% liquid smoke, T2: CWMB ration with 0.50% liquid smoke, T3: CWMB ration with 0.75% liquid smoke. The data obtained were analyzed with Completely Randomized Design (CRD) with 4 treatments and 4 replications. The results showed that the effect of liquid smoke in the CWMB ration significantly affected (P <0.05) the consumption of crude protein, crude fiber, crude fat and nitrogen-free extract. Based on these results, it can be concluded that the addition of liquid smoke in the CWMB ration at different levels affected the quail consumption and nitrogen-free extract. The best results obtained in the 0.75% liquid smoke supplementation (T3) that can increase consumption of crude protein and crude fiber in quails. However, the addition of liquid smoke at 0.25-0.75% to CWMB ration can increase quail’s crude fat consumption and nitrogen-free extract.

1. Introduction

The potential increase of quail production requires proper management especially in feed. Feed is a nutritive source required by livestock either for production or basic living. The applied composition of feedstuff in formulating the ration should also be balanced in order to achieve optimal growth and production. The farmers should provide potential alternative of inexpensive and obtainable feed such as Coconut Water Multinutrient Block (CWMB). CWMB is one combined feed formula to fulfill livestock nutritive need by supplying coconut water. Coconut water contains low carbohydrate, but it is rich in minerals including calcium (Ca), sodium (Na), magnesium (Mg), and phosphorus (P) [1,2]. Calcium and phosphorus are very essential nutritive content for bone formation in livestock. In addition, one feed component that is frequently used by the farmer is additive substance. Additive substance is one feedstuff or feedstuff combination supplemented in feed in low quantity to fulfill particular needs such as enhancing growth and digestibility [3]. One potential feedstuff served as additive substance in livestock feed is liquid smoke [4].

Liquid smoke is a natural preservative containing 200 chemical components and functions as antibacteria and antioxidant in preserving feedstuff [5,6]. According to a study [7] showed that the substances of Polycyclic Aromatic Hydrocarbon (PAH) including benzopyrene cannot be found in liquid smoke of coconut shell. Also, liquid smoke from the coconut shell is capable of stimulating sensory characteristics such as odor, color, and unique taste in food products. Liquid smoke has resulted from distillation or condensation of either combustion vapor or materials that are rich in carbon and
other substances. Commonly, liquid smoke is used as preservative and antioxidant due to its phenol and carbonyl content.

Furthermore, liquid smoke contains various acid substances such as lactic acid and butyric acid. Both of the acidic substances are necessary for optimizing the metabolism process of nutritive substances in the digestive tract and improving the feed texture. Consequently, this may generate the effect of increasing feed consumption in quails. Studies concerning the liquid smoke in coconut water multi-nutrient block are still very rarely performed. Therefore, this study will focus on the liquid smoke utilization in coconut water multi-nutrient block as quail feedstuff. This study aims to identify the effect of liquid smoke supplementation at different concentration in coconut water multi-nutrient block to the nutrient consumption such as crude protein, crude fiber, crude fat, ad nitrogen-free extract in quails.

2. Research method

2.1. Research material

This study was performed for 3 months in 2017 in the Feed Industry Laboratory and Feed Chemical Analysis Laboratory, Faculty of Animal Science, Hasanuddin University. The ration feedstuffs in this study are coconut water, soybean meal, rice bran, yellow corn, tapioca flour and fish flour. As many as 64 DOQ (day-old quail) were used in this study. Nutritive contents of each used feedstuff in the formulation of coconut water multi-nutrient block (CWMB) were presented in Table 1.

| Feedstuff     | ME (kcal) | CP (%) | CF (%) | CF* (%) | Ca (%) | P (%) |
|---------------|-----------|--------|--------|---------|--------|-------|
| Rice Bran     | 2980      | 11.67  | 10.4   | 17.29   | 0.07   | 0.22  |
| Soybean Meal  | 2290      | 48.0   | 0.41   | 0.51    | 0.41   | 0.67  |
| Tapioca Flour | 2970      | 2.50   | 4.00   | 0.50    | 0.30   | 0.12  |
| Fish Flour    | 2730      | 55.0   | 0.70   | 7.72    | 5.00   | 2.50  |
| Yellow Corn   | 3350      | 8.00   | 2.20   | 3.80    | 0.02   | 0.28  |

Description: ME : Metabolism Energy; CP: Crude Protein; CF : Crude Fiber; CF: CF*: Crude Fat; [8,9]

2.2. Research stage

2.2.1. Coconut Water Multi-nutrient Block Ration formulation. The feedstuffs used in the CWMB ration formulation were weighed based on each treatment formulation consisting of corn, rice bran, soybean meal, tapioca flour, fish flour, 0.5% minerals. After the feedstuffs were mixed evenly, liquid smoke was added based on the treatments along with the coconut water for 15% and homogenized. Before feeding the quails, the ration combination was aerated. The samples were stored in the available containers and labelled according to the treatment factor.

2.2.2. Experimental pen. The experimental pen used in this study was a quail pen with the size of 45 x 46 x 40 cm, equipped with feeder and drinker, faeces container and lighting. Before the pen was used, disinfectant was applied. Each pen contained 4-day old quails with the average weight of ±7 grams which were supplied by CV Bittara Wanua farm, Laikang, Biringkanayya Sub-District, Makassar City.

2.2.3. Quail maintenance. There were 64-day old quails placed in the pen with a density of 4 quails/ pen with ad libitum access of feeding and drinking. Feed was provided in every morning and afternoon. The research was performed for 3 weeks (21 days). Adaptational period for one week was prepared for the quails with treatment ration and new circumstance. At the beginning of the research, the ration was weighed for 100 grams/ sample to identify the crude protein and crude fiber content through proximate analysis. Feeding rate was calculated each day during the experiment.
2.2.4. Research design. This study was designed based on the completely randomized design (CRD) consisting of 4 treatments and 4 replications. The treatments were: T0: CWMB without liquid smoke supplementation; T1: CWMB with 0.25% liquid smoke supplementation; T2: CWMB with 0.50% liquid smoke supplementation; T3: CWMB with 0.75% liquid smoke supplementation. The ration was formulated with crude protein content ranging from 22-23% and metabolism energy ranging from 2900-3000 kcal. The effect of the treatment on the measured parameters was analyzed statistically [10] with SPSS v.16.0. Duncan’s Multiple Range Test (DMRT) is used to measure specific differences among the treatments.

2.2.5. Observed parameters. The observed parameters in this study were nutrient consumption such as crude protein, crude fiber, crude fat and nitrogen-free extract and were measured during the research (21 days).

3. Results
The average nutrient consumption of quail with liquid smoke supplementation at different concentration in CWMB ration was presented in table 2.

Table 2. The average value of crude protein and crude fiber consumption.

| Parameter         | Treatment | T0     | T1     | T2     | T3     |
|-------------------|-----------|--------|--------|--------|--------|
| CPC (g/h/d)       | 2.07±0.02 | 2.21±0.03 | 2.34±0.04 | 2.34±0.03 |
| CFibC (g/h/d)     | 0.23±0.00 | 0.24±0.00 | 0.25±0.00 | 0.24±0.00 |
| CFC (g/h)         | 0.23±0.00 | 0.26±0.00 | 0.26±0.00 | 0.27±0.00 |
| NFEC (g/h)        | 3.83±0.05 | 3.94±0.06 | 3.89±0.08 | 3.82±0.06 |

CPC: Crude Protein Consumption; CFibC: Crude Fiber Consumption; CFC: Crude Fat Consumption; NFEC: Nitrogen-Free Extract Consumption; T0: CWMB without liquid smoke supplementation; T1: CWMB with 0.25% liquid smoke supplementation; T2: CWMB with 0.50% liquid smoke supplementation; T3: CWMB with 0.75% liquid smoke supplementation. The values with different superscript letters in a column are significantly different (P<0.05).

4. Discussion
According to analysis of variance result, Supplementation of liquid smoke at different concentration in CWMB ration significantly affected (P<0.05) the crude protein consumption in quails. Duncan Multiple Range Test (DMRT) showed that the treatment results of T1, T2 and T3 were significantly higher than T1 while T2 and T3 were significantly higher than T0 and T1. T2 had no significant difference from T3. The result of crude protein consumption in each treatment ranged from 2.07 – 2.34 g/h/d. This was in line with a study performed by [11] that the average crude protein consumption per day in DOQ was 2.216 g/h/d.

Based on table 2, T0 indicated low crude protein consumption compared to other treatments with liquid smoke supplementation. The increase in crude protein consumption was affected by the higher feed consumption in T1, T2, and T3 due to the increasing palatability generated by the liquid smoke supplementation. This was similarly stated by [12] that liquid smoke may enhance the odor and texture of food. Coconut water contains much important nutrition for livestock such as protein, fat, carbohydrate, mineral and vitamin [13]. Moreover, coconut water also contains antibacteria, antivirus, antifungal, antidote for certain substances and antioxidant. Liquid smoke is categorized as sensory additive affecting taste and color of feed, coccidiostats, and hismonostats (antiprotozoal agent that acts upon parasites in digestive system). Liquid smoke also functions as nutritional additive to enhance growth in livestock and zootechnical additive that enhance feed efficiency. This classification is grounded on the liquid smoke substance, such as phenol and carbonyl that plays the role of antibacteria and antioxidant controlling microbial growth. Additionally, both substances also produce specific odor and color [14].
Based on the variance analysis, it showed that liquid smoke supplementation at different concentration in CWMB ration significantly affected (P<0.05) the crude fiber consumption in quails. The results of Duncan Multiple Range Test (DMRT) showed that T1, T2, and T3 treatments were significantly higher compared to T0. On the contrary, T1, T2 and T3 treatments were not significantly different in crude fiber consumption in quails. Such condition was resulted by the chemical substance of liquid smoke that increased the consumption rate in quails. These results are in line with the study performed by [15] stating that the chemical compositions of liquid smoke include acid affecting taste, pH and shelf life, carbonyl reacting with the protein and producing brown color, and phenol producing odor and indicating antioxidant activity [16].

Table 2 showed that the treatment of liquid smoke supplementation at different concentration in CWMB ration resulted in crude fiber consumption increase. This was due to the odor and texture change of CWMB ration that could increase ration palatability. Different rate in consumption was affected by certain numerous factors such as livestock factor (body weight and age), feed digestibility, palatability and feed quality [17]. Research [18] that feed consumption is primarily affected by feed quality factor and energy need factor in livestock.

According to analysis of variance, it showed that the supplementation of liquid smoke at a different concentration significantly affected (P<0.05) crude fat consumption. The result of Duncan Multiple Range Test showed that crude fat consumption without liquid smoke supplementation (T0) was significantly lower compared to the treatments with liquid smoke supplementation at different concentration (T1, T2, and T3). On the other hand, 0.75% liquid smoke supplementation (T3) contributed to significantly higher increase in crude fat consumption compared to T1 (0.25%) and T2 (0.50%). Liquid smoke supplementation in feed may increase feed consumption. This was due to the change in specific color, odor and taste in feed enhancing palatability. Consequently, consumption rate of the ration also increased. As the feed consumption rate increased, the crude fat consumption in livestock also increased. Palatability is one very crucial factor that determines feed consumption rate in which palatability of feed is affected by taste, odor and color as the physical and chemical factor in feed.

As can be seen from the results of analysis of variance, liquid smoke supplementation in CWMB ration at different concentration significantly affect (P<0.05) the nitrogen-free extract consumption in quails. The result of Duncan Multiple Range Test showed that nitrogen-free extract consumption in T0 was not significantly different from the treatments of T1, T2, and T3. However, T1 treatment was significantly higher than the T3. Although T0 was not significantly different from other treatments, it can be seen that liquid smoke supplementation in ration boosted nitrogen-free extract consumption. The tendency of increasing NFE in this research was most probably due to the increasing consumption in other components such as crude fiber, crude protein and crude fat that played a very important role in affecting NFE consumption. According to study [19], NFE consumption rate of a feedstuff is very dependent on other components such as moisture content, crude fat, crude fiber, and crude protein.

The increasing NFE consumption is very advantageous because the higher the increase in NFE consumption, the higher the organic matter consumed and consequently, the higher the calories produced. This is in accordance with a study performed by [19] revealing that high NFE content is very necessary for the livestock to produce energy.

5. Conclusion
Based on the result and discussion of this study, it can be concluded that the most effective supplementation of liquid smoke in CWMB was at the concentration of 0.75% that could increase significantly the crude fiber and crude protein consumption in quails. Liquid smoke supplementation at 0.25-0.75% concentration in CWMB ration could increase crude fat and NFE consumption in quails.

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References

[1] Thampan P and Rethinam P 2004 Coconut products for health and medicine Indian Coconut J. 35 6–15
[2] Suryanto E 2009 Air kelapa dalam media kultur anggrek (http://wawaorchid.wordpress.com/2009.html).
[3] Sofyan A, Sulendra H, Damayanti E, Sutrisno B and Wibowo M H 2010 Performa dan histopatologi ayam broiler yang diinfeksi dengan Salmonella pullorum setelah pemberian imbuhan pakan mangandung tepung cacing tanah (Lumbricus rubellus) Media Peternakan 33 36
[4] Wang H, Wang J L, Wang C, Zhang W M, Liu J X and Dai B 2012 Effect of bamboo vinegar as an antibiotic alternative on growth performance and fecal bacterial communities of weaned piglets Livest. Sci. 144 173–80
[5] Nomura R 2004 Healthy effects of bamboo vinegar Nobunkyou Publ. 141-3
[6] Mu J, Uchara T and Furuno T 2004 Effect of bamboo vinegar on regulation of germination and radicle growth of seed plants II: composition of moso bamboo vinegar at different collection temperature and its effects J. Wood Sci. 50 470–6
[7] Budijanto S, Hasbullah R, Prabawati S and Zuraida I 2019 Identifikasi dan uji keamanan asap cair tempurung kelapa untuk produk pangan J. Penelit. Pascapanen Pertan. 5 32–40
[8] [NRC] National Research Council 1994 Nutrient Requirement of Poultry (Washington, DC: National Academy Press)
[9] Anggorodi H R 1995 Nutrisi Aneka Ternak Unggas (Jakarta: Gramedia Pustaka Utama)
[10] Steel R G D and Torrie J H 1980 Principles and Procedures of Statistics: A Biometrical Approach (New York: McGraw-Hill Book Co)
[11] Mahfudz L D 2006 Efektifitas oncom ampas tahun sebagai bahan pakan ayam pedaging J. Produksi Ternak 8 108–14
[12] Ramakrishnan S and Moeller P 2002 Liquid Smoke: Product of Hardwood Pyrolysis. Fuel Chem. Div. Prepr. 47 366–7
[13] Mide Z, Jasmal J A, Ismartoyo, Harfiah, Rusdy, Syahrir S, Nompo S, Rinduwati and Asriany A 2014 Pembuatan suplemen air kelapa blok pada sapi potong (Makassar: Universitas Hasanuddin)
[14] Sari M, Lubis F and Jaya L 2014 Pengaruh pemberian asap cair melalui air minum terhadap kualitas karsa ayam broiler J. Agripet 14 71
[15] Fatimah I and Nugraha J 2005 Identifikasi hasil pirolisis serbuk kayu jati menggunakan principal component analysis J. Ilmu Dasar 6 41–7
[16] Sischa J U, Anastasia, Dinata A A N and Guntoro S 2008 Pemanfaatan asap cair sebagai obat scabies pada kambing National Seminar on Livestock Science and Veterinary Technology (Bandung) pp 504–9
[17] Parakkasi A 1991 Ilmu Nutrisi dan Makanan Ternak Ruminansia (Jakarta: Universitas Indonesia (UI) Publisher)
[18] Perry T W, Culliison A E and Lowrey R S 2003 Feed and Feeding (New Jersey: Person Education, Inc)
[19] Sutardi T 2006 Landasan Ilmu Nutrisi (Bogor: Department of Animal Nutrition. Faculty of Animal Science IPB)