The Effect of The Use of Fish Flour as a Source of Protein in Complete Feeds on The Digestivenes of Fat, Crude Fiber and Nitrogen-Free Extract Ingredients in Bali Cattle Fattened

Agustinus Mau Mori[1], Oktovianus Rafael Nahak[1], Paulus Klau Tahuk[1]
[1]Program Study of Animal Husbandry, Faculty of Agriculture Universitas Timor
Corresponding author : paul klau@yahoo.com.id

Abstract

The research has been carried out for 3 months, starting from May 13 to August 13, 2021 in the experimental cage of the Faculty of Agriculture, University of Timor, while the analysis of digestibility of fat, crude fiber, and Extract Material Without Nitrogen (EMWN) at the Chemistry Laboratory of the Faculty of Animal Husbandry, University of Nusa Cendana. The purpose of this study was to determine the effect of using fish meal as a protein source in a complete feed on the digestibility of fat, crude fiber, and EMWN in fattened male bali cattle. The method used in this study was a completely randomized design (CRD) which consisted of 3 treatments and 5 replications so that there were 15 experimental units. The treatments were: T1= Natural grass 30% + Milled corn 42% + Rice bran 13% + Brand Pollard 11% + Fish meal 4%, T2= Natural grass 30% + Milled corn 42% + Rice bran 9% + Brand Pollard 11% + fish meal 8%, T3=. Natural grass 30% + Milled corn 42% + Rice bran 5% + Brand Pollard 11% + fish meal 12%. The variables tested included Fat Digestibility (%), Crude Fiber Digestibility (%) and EMWN Digestibility%. The results of analysis of variance showed that digestibility of crude fat and digestibility of crude fiber had a significant effect ($P<0.05$) and digestibility of EMWN had no significant effect ($P>0.05$) on the percentage of digestibility of fat produced T1: 19.06%; T2; 34.11%; T3: 69.31%, digestibility of crude fiber produced T1: 42.13%; T2: 29.02%; T3: 18.52% and the resulting EMWN T1: 65.01%; T2: 60.28%; T3: 62.31%. It can be concluded that the use of completed feed prepared with fish meal containing 12% protein increased the crude fat digestibility value but the crude fat digestibility was lower when compared to 4% fish meal and 8% in fattened bali cattle. Meanwhile, the digestibility of EMWN was not affected by the use of different levels of fish meal in complete feeds.

Key word : Bali Cattle, Complete Feed, Fish meal, Fat digestibility, Crude fiber, EMWN

Introduction

Bali cattle are one of the original Indonesian germplasms that have the potential as beef cattle and have a good marketing point of view to fulfill meat needs. Bali cattle can supply about 26% of the total beef cattle in Indonesia (Guntoro, 2006). The productivity of local cattle in Indonesia is relatively low, because most breeders in Indonesia still use the traditional system of rearing with makeshift feeding (Muladno, 2012). Winugroho et al. (2007) reported that an animal that gets feed in an amount that does not meet the needs will cause stress and a decrease in live weight of the animal.

Bali cattle are one of the large ruminants in East Nusa Tenggara and are currently being cultivated by the community to meet the needs of animal protein for the community. Increasing the productivity of Bali cattle can be done through the provision of high-quality feed in the fattening program with the aim of providing nutrient needs so as to increase the live weight of livestock. Providing complete feed is one solution because complete feed contains complete nutrients needed by livestock for production, besides that complete feed is also a solution in anticipating the shortage of forage in the dry season. According to Ensminger (1991), the use of complete feed will bring benefits such as increasing feeding efficiency, increasing livestock consumption when forage is not preferred by livestock, making it easier for farmers to get complete feed. Completed feed is rich in nutrients needed by livestock to support the growth and development of livestock. The nutrients contained in the form of crude fiber, fat and EMWN.

Crude fiber is a nutrient component that is difficult to degrade in the digestive tract. The content of crude fiber in the feed given affects feed consumption because crude fiber has a bulky (volumenous) nature consisting of cellulose, hemicellulose and lignin. Crude fiber has benefits, namely helping intestinal peristalsis, preventing rations from clumping together, accelerating the rate of digestion and spurring the development of digestive organs (Amrullah, 2003). While EMWN is a soluble carbohydrate including monosaccharides, disaccharides and polysaccharides that are easily soluble in acid and alkaline solutions and have high digestibility (Anggorodi, 2005). EMWN is a soluble part that is easily degraded in the rumen, this has an impact on consumption levels. Hadi et al. (2011) stated that feed containing rumen soluble parts will be easily degraded by rumen microbes, which will increase consumption. Increased protein affects the absorption or utilization of food substances, so that the digestibility of EMWN tends to increase. Increased protein affects the absorption or utilization of food substances, so that the digestibility of EMWN tends to increase (Budiman et al. 2006).

The level of nutrient digestibility of a feed can determine the quality of the ration. The amount of digestibility determines the amount of nutrients that can be utilized to meet basic life needs and growth (Widya et al., 2008; Sondakh et al., 2018; Tulung et al., 2020). Digestibility is the difference between the food substances consumed and those secreted in the feces and considered absorbed in the digestive tract. Digestibility is an illustration of the amount of nutrients in feed ingredients that can be utilized by livestock. The high and low digestibility of feed ingredients shows how much the feed ingredients contain food substances in a form that can be digested in the digestive tract.

Nutrient digestibility is one indicator to determine the quality of the ration. The higher the digestibility of fat, the higher the opportunity for nutrients that can be utilized by livestock for growth. Fat digestibility is related to the metabolism that occurs in livestock. The higher the percentage of fat digestibility, the better the metabolism that occurs in the animal's body. Feeding protein sources can come from plants or animals. One of the sources of animal protein feed that is rich in protein is fish meal.

Fish meal is a feed source of animal protein which is commonly used in monogastric livestock rations. The need for livestock for animal protein source feed is very important, because it has a relatively high protein content composed of complex essential amino acids that can affect the growth of animal tissue cells (Purnamasari et al. 2006). Good fish meal has a crude protein content of 58-68%, water 5.5-8.5%, and salt 0.5-3.0% (Sitompul, 2004).

Fish meal is one of the animal feed ingredients that has the potential as a source of protein and fat, especially long-chain unsaturated fatty acids (PUFA) which are known to play a major role in improving livestock reproduction (Ashes et al., 1992; Palmqurist and Kinsey). , 1994; Spain et al., 1995). Mandel et al, (1997) stated that fish meal contains a lot of essential fatty acids eicosapentaenoic acid (EPA), (20:5n-3) as much as 5.87 g and docosahexanoic acid (DHA), (20:6n-3) as much as 9.84 g/kg.

Fish meal in complete feeds has a balanced nutritional value so that it can contribute positively to the level of Digestibility of Fat, Crude Fiber, and EMWN (Extracted Materials Without Nitrogen) in the rumen.

Materials and Methods

Cattle

The livestock used in this study were male Bali cattle aged 1.5 to 2 years totaling 15 heads with an initial body weight range of 100 - 160 kg.

Tool

The tools used were 2 cutting machines to cut grass, a milling machine for grinding grass and corn in addition to a scale to weigh feed for feeding to livestock during the study period. Scales with a capacity of 2 tons for weighing livestock, buckets for feeding livestock, and other equipment in the form of stationery, books, cameras and cloth analysis tools.

Ingredient

The materials used in this study were field grass, fish meal, corn flour, brand pollard, rice bran, minerals and formalin which were used in preserving feces samples taken.

Cage

The cage used in this study was an individual cage with an elongated shape. The cage consisted of 15 plots with a size of each plot of 250 x 150 cm. The height of the cage is 200 cm, each cage plot is equipped with a place for feed and drinking water.

Research methods

The research method used in this study was a completely randomized design (CRD) consisting of 3 treatments and 5 replications so that there were 15 experimental units of treatment given as follows:

T1 : Natural grass 30% + Milled corn 42% + Rice bran 13% + Brand Pollard 11% + Fish meal 4%

T2 : Natural grass 30% + Milled corn 42% + Rice bran 9% + Brand Pollard 11% + fish meal 8%

T3 : Natural grass 30% + Milled corn 42% + Rice bran 5% + Brand Pollard 11% + Fish meal 12%

Table of Nutritional content of ingredients for complete feed rations

Nutrient feed	Ingredient				
	Natural grass	Bran pollard	Fish meal	Corn	Rice bran
DM (%)	90.668	87.628	91.034	88.194	90.050
OM (%)	82.318	82.970	70.148	86.905	76.318
CP (%)	2.773	18.500	55.674	9.891	8.602
CFt (%)	1.387	5.468	8.922	4.891	9.677
CF (%)	35.656	6.729	4.894	1.712	18.290
CHO (%)	78.159	59.002	5.552	72.696	58.040
FEN (%)	42.500	52.273	0.658	70.984	39.750
Gross energy - (MJ/kg)	14.667	16.557	17.498	16.503	15.427
- (Kkal/kg)	3,492.05	3,942.08	4,166.17	3,992.38	3,673.09
EM (kkal/kg)	2,053.42	3,408.55	2,958.92	3,792.41	2,868.76

Note : The results of the analysis of the feed chemistry laboratory of the Faculty of Animal Husbandry, Nusa Cendana University (2021)

Research procedure

Preparation time

In the preparation period, the things that this researcher did were to prepare the cage and prepare the feed. The cages needed in this study were 15 plots, the size of the cages made was 250 x 150cm. Materials used with wooden planks. After the cage was finished, it was continued by cutting the grass around km 9 Kefamenanu City. After the grass is cut, it is left to dry and then transported to be ground using a milling machine, after the grass has been milled it is packed in sacks. The next stage is the preparation of ground corn, brand pollard, rice bran and fish meal for the manufacture of concentrates. All ingredients are mixed and the percentage is according to the treatment prepared. The prepared feed ingredients are then mixed thoroughly and then packed in sacks and ready to be given to livestock.

Livestock adaptation

Bali bulls that have been weighed are initially put into individual cages that have been made to be adapted to the ration for 2 weeks or to the rations consumed by the male bali cattle in normal amounts. The purpose of livestock adaptation is to adapt livestock to the environment and feed treatment.

Data

The data collected is data on the expulsion of feces by livestock. Feces were collected for 24 hours for 10 days of observation. The feces released by the cattle were weighed using a hanging scale and after being weighed, a sample of 200 grams was taken. Fecal samples taken were sprayed with formalin and dried in the sun to dry. Dried feces are stored and labeled according to the treatment of livestock. After 10 days of collection,

the dried faecal samples were mashed for analysis of chemical composition at the feed chemistry laboratory of the Faculty of Animal Science, Universitas Cendana.

Research variable

Crude Fat Digestibility

Crude fat digestibility is one indicator to determine the quality of the ration. The higher the digestibility of fat, the higher the opportunity for nutrients that can be utilized by livestock for growth. Crude Fat Digestibility can be known through Crude Fat consumed in feed and feces collection issued by Livestock for 10 days.

Crude fat digestibility can be calculated using the formula (Snedecor and Cochran, 1989; Derrick et al. 2017). As follows:

$$\text{Crude Fat digestibility (\%)} = \frac{Crude\ fat\ consumption(kg) - Crudefat\ Feses(kg)}{Crude\ fat\ cosumption\ (kg)} X\ 100\%$$

Crude Fiber Digestibility

Crude fiber is a nutrient component that is difficult to degrade in the digestive tract. Crude fiber digestibility was calculated using the formula (Tillman et al., 1991) as follows:

$$\text{Crude fiber digestibility (\%)} = \frac{Crude\ fiber\ consumption(kg) - \text{Crudefiber}\ Feses(kg)}{Crude\ fiber\ consumption\ (kg)} X\ 100\%$$

EMWN Digestibility

EMWN is a soluble carbohydrate including monosaccharides, disaccharides and polysaccharides that are easily soluble in acid and alkaline solutions and have high digestibility (Anggorodi, 2005). To measure the digestibility of EMWN, the formula according to (Snedecor and Cochran, 1989; Derrick et al., 2017): as follows:

$$\text{FEN digestibility (\%)} = \frac{\text{FEN cosumption}\ (kg) - \text{FEN}\ Feses(kg)}{\text{FEN cosumption}\ (kg)} X\ 100\%$$

Data analysis

The data obtained were tabulated using Analysis of Anova in accordance with the research design used Completely Randomized Design (CRD). Followed by Duncan's multiple distance test to see the difference between treatments (Steel and Torrie, 1995). Data analysis using SPSS 22 software

Results and Discussion

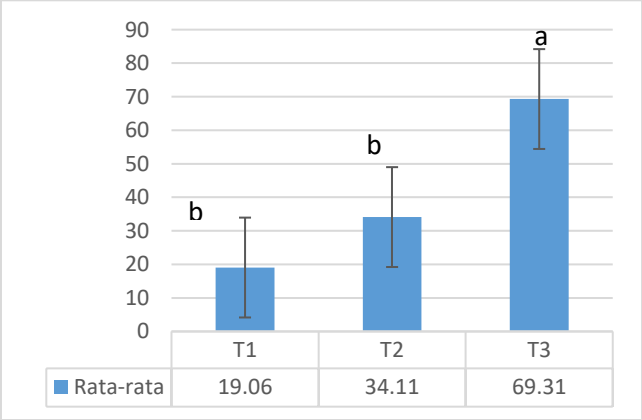
Effect of Treatment on Crude Fat Digestibility of Bali Cattle

Crude fat digestibility is the crude fat portion of the feed that is not excreted in the feces. Wina and Susana (2013) stated that fat is the main element of animals and is an important source of stored energy. Crude fat serves as a high-density energy source. Fatty

acids will produce higher energy compared to other nutrients such as carbohydrates or protein when metabolized in the body.

The effect of using fish meal as a protein source in complete feeds on crude fat digestibility of Bali cattle is shown in Graph 1.

Graph 1. Average crude fat digestibility of male bali cattle (%)



Note **;** a,b, superskrip on graph show difference (P<0,05).

The results of the study in graph 1 show that the highest crude fat digestibility is shown in treatment T3: 69.31% followed by T2; 34.11% and the lowest crude fat digestibility in T1 treatment was 19.06%.

Analysis of variance (Anova) showed that the provision of fish meal as a source of protein in complete feeds had a significant effect (P<0.05) on the crude fat digestibility value. It can be said that the application of fish meal with different levels can affect the digestibility of crude fat.

The results of Duncan's test showed that the provision of fish meal with a level of 4% (T1) and 8% (T2) was not statistically significantly different, while the treatment with fish meal with a protein level of 12% (T3) was significantly different from T1 and T2.

The digestibility of crude fat T3 was higher than T2 and T1, indicating that the level of protein in the form of 12% fish meal in the T3 treatment was quite balanced both in protein and energy content so as to increase the activity of rumen microorganisms in digesting the food consumed. The effect of treatment on different crude fat digestibility values, due to the different nutrient content in the feed.

Palmquist and Kinsey (1994); and Spain et al. (1995) stated that fish meal contains about 8–10% fat, of which 2/3 of it is in the form of long-chain unsaturated fatty acids (PUFA), including Omega 3 fatty acids, namely Eicosapentaenoic acid (EPA). , C20:5n3) and Docosahexanoic acid (DHA, C20:6n-3). Suardin et al. (2014) stated that in terms of feed digestibility is influenced by the treatment of feed (processing, storage and administration) type, amount and composition of feed given to livestock.

Toharmat et al. (2006) stated that high fat content in feed causes low digestibility values, because feed digestibility is negatively correlated with feed fat. in fat there is a chemical structure that is easily digested by livestock, so if the crude fat value is low, the crude fat digestibility value is high (Farida et al., 2017). The digestibility of a feed

depends on the quality of the food substances contained in the feed so that it affects the growth of microorganisms (Sastrawan, 2009).

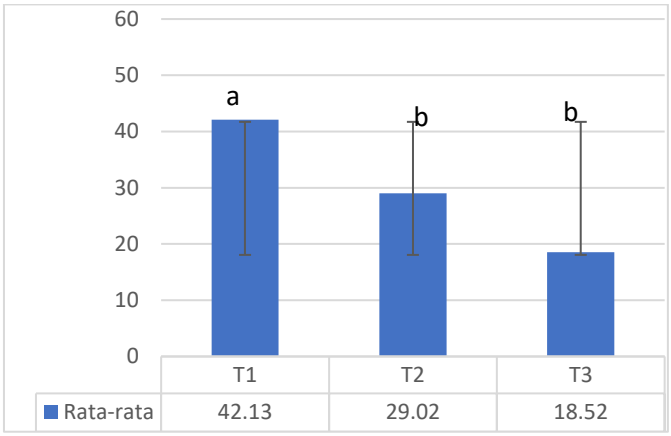
Sandri (2009) states that the digestibility of a feed depends on the quality of the nutrients contained in the feed so that it affects microorganisms. Factors that affect the digestibility value are chemical and physical content of feed ingredients and livestock conditions such as microbial conditions in the rumen (Paramita et al., 2008). The high digestibility of crude fat is caused by the chemical structure of fat which is easily digested (Wiseman, 1990).

Effect of Treatment on Digestibility of Crude Fiber in Bali Cattle

Crude fiber is part of the carbohydrate nutrients that are not easily soluble in water consisting of cellulose, hemicellulose and lignin. Tillman et al, (1983) stated that the higher crude fiber content causes the lower crude fiber digestibility, because feeds containing high crude fiber will be digested more slowly and less when compared to feeds containing less crude fiber. Crude fiber is a carbohydrate group that functions to fill and keep the digestive tract working properly, and encourage the digestive glands to secrete digestive enzymes.

The effect of using fish meal as a source of protein in complete feeds on the digestibility of crude fiber for Bali cattle is shown in Graph 2.

Graph 2. Average digestibility of male Bali cattle crude fiber (%).



Note **;** a,b, superscript on graph show significant (P<0,05).

The results of the study in Figure 2 show that the highest digestibility of crude fiber is seen in T1 treatment of 42.13% followed by T2 treatment of 29.02% and T3 of 18.52%.

Analysis of variance (Anova) showed that the provision of fish meal as a source of protein in complete feeds had a significant effect (P<0.05) on the digestibility value of crude fiber. It can be said that the application of fish meal with different levels can affect the digestibility of crude fiber.

The results of Duncan's test showed that the provision of fish meal as a protein source with levels of 8% (T2) and 12% (T3) was not statistically significantly different, while the treatment with fish meal with a protein level of 4% (T1) was significantly different from T2 and T3.

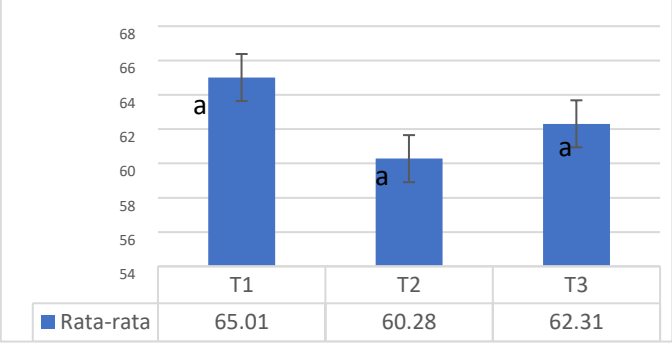
The high digestibility of T1 crude fiber with a protein level in the form of 4% fish meal is due to the composition of nutrients and the materials provided have a very adequate nutrient balance so that they can be absorbed by the animal's body maximally with the help of microorganisms in the body. Schroeder (1999); Anonymous (2001); Stallings (2003) stated that fish meal is a feed ingredient that is rich in protein but has low palatability, especially for ruminants because of its sharp aroma, so its use in feed should be limited.

The digestibility value of crude fiber was different in the treatment, due to the different nutrient content in the feed. Wijayanti et al. (2012) stated that high crude fiber content in feed causes low digestibility, due to high fiber walls which cause cell walls to become thick and difficult for rumen microbes to penetrate. Sanchez (2009) stated that the decrease in crude fiber content due to microbial activity resulted in an increase in the BETN content, with more simple sugars produced. Bakara et al. (2012) stated that the high content of crude fiber in feed will accelerate the rate of food travel in the digestive tract and have an impact on decreasing the chance of the gastrointestinal tract to absorb other food substances contained in the feed. Maynard et al. (2005) stated that the digestibility of crude fiber is influenced by several factors, including fiber content in feed, crude fiber composition and microorganism activity. Hidanah et al. (2013) stated that the digestibility of crude fiber is influenced by several factors including feed consumption, fiber content in feed, crude fiber composition and microorganism activity. Adrizal et al., (2011) stated that the amount of feed consumed does not guarantee an increase in the digestibility of food substances even though the quantity of feed substances is the same or more. crude fiber digestibility. Perry et al. (2003) stated that feed ingredients containing high crude fiber will reduce the digestibility value of other food substances because digesting crude fiber requires a lot of energy.

Effect of Treatment on Digestibility of Bali Cattle BETN

FEN are soluble carbohydrates including monosaccharides, disaccharides and polysaccharides that are easily soluble in acid and alkaline solutions and have high digestibility (Anggorodi, 2005). BETN is the content of food substances minus the percentage of water content, ash content, crude protein content, crude fat content, crude fiber and BETN levels are calculated as by-product nutrients from protein (Susi, 2001). The effect of using fish meal as a protein source in complete feed on the digestibility of BETN Bali cattle is shown in Graph 3.

Graph 3. Average digestibility of male Bali cattle EMWN (%)



Note : same letter a in the graph above shows no significant effect (P> 0.05).

The results shown in graph 3 show that the highest digestibility of EMWN is shown in treatment T1 of 65.01%, followed by T3 of 62.31% and the lowest is T2 of 60.28%.

The results of Duncan's test in each treatment showed that the provision of fish meal as a source of protein at the levels of 4%, 8% and 12% had no significant effect (P>0.05) on the digestibility of the resulting EMWN, meaning that the provision of fish meal as a source of protein in livestock had a treatment effect. which was not much different between the three treatments, so that the digestibility of EMWN was relatively the same between treatments. However, quantitatively, there was a tendency for the digestibility of EMWN in T1 treatment to be higher than the other two treatments, followed by T3 and T2 treatments.

The high digestibility of EMWN in the T1 treatment was due to the composition of nutrients and the feed ingredients provided had a very adequate nutrient balance so that they could be absorbed by microorganisms.

The digestibility value of extra material without nitrogen is influenced by the consumption of a feed in the amount of feces produced. The digestibility value of extra material without nitrogen is high if the consumption power and the amount of feces are in the same condition (Diputro, 2008). EMWN is a soluble part that is easily degraded in the rumen, this has an impact on consumption levels. Hadi et al. (2011) stated that feed containing rumen soluble parts will be easily degraded by rumen microbes, which will increase consumption. A balanced protein and EMWN content will act as a carbon skeleton and a source of NH3 and energy to support protein synthesis of rumen microorganisms (Andrew et al. 1995)

Budiman et al. (2006) reported that an increase in protein affects the absorption or utilization of food substances, so that the digestibility of EMWN tends to increase.

Conclusion

Based on the results and discussion, it was concluded that the use of fish meal as a protein source in a complete feed with a protein level of 12% prepared by treatment (T3) resulted in a higher crude fat digestibility value and the highest crude fiber digestibility and EMWN at T1 with a protein level of 4%.

References

Adrizal, A., Y. Yusrizal, S. Fakhri, W. Haris, E. Ali. and C. Angel. 2011. Feeding native laying hens diets containing palm kernel meal with or without enzyme supplementations : Feed conversion ratio and egg production. J. Appl. Poult. Res. 20: 40-49.

Amrullah, I. K. 2003. Nutrisi Ayam Petelur. Lembaga Satu Gunung Budi, Bogor.

Andrae JG, Duckett SK, Hunt CW, Pritchard GT, Owens FN. 2001. Effects of feeding high-oil corn to beef steers on carcass characteristics and meat quality. J Anim Sci 79: 582-588.

Andrew, SM, RA Erdman, and DR Waldo. 1995. Prediction of body compotition body cows at three physiological stages from deuterium oxide and urea dilution. J Dairy Sci 78: 1083-1095.

Anggorodi. R. 2005. Ilmu Makanan Ternak Umum. Gadjah Mada University Press. Jogjakarta.

Anonymous. 2000. Feed fishmeal to growing beef cattle for costeffective extra weight gain and leaner carcasses. Fishmeal Information Network (FIN). Press Release-12, 26 June 2000. 4 The Forum, Minerva Business Park, Peterborough, Cambridgeshire. PE2 6FT.

Anonymous. 2001a. Advisory Committee on Animal Feedingstuffs (ACAF). The use of fish meal in animal feeds. 8th Meeting of ACAF 28 February 2001. Agenda Item 3. London.

Anonymous. 2001b. Fish meal, Menhaden. Ingredients 101.com. PO. Box 420, Grafton, WI 53024.

Anonymous.1999. Feeding fish meal improves cow fertility. Fishmeal Information Network (FIN). Nutritional Paper 4. 4 The Forum, Minerva Business Park, Peterborough, Cambridgeshire. PE2 6FT, UK.

Arief, D., dan Arianti. (2000). Evaluasi ransum yang menggunakan kombinasi pollard dan duckweed terhadap persentase berat karkas, bulu, organ dalam, lemak abdominal, panjang usus & sekum ayam kampung. Bogor: Institut Pertanian Bogor.

Ashes, J.R., B.D. Sieber, S.K. Gulati, A.Z. Cuthbertson, and T.W. Scott. 1992. Incorporation of nfatty acids of fish oil into tissue and serum lipids of ruminants. Lipids. 27 (8): 629-631.

Astuti A, Agus A, Budi SPS. 2009. The effect of highquality feed supplement addition on the nutrient consumption and digestibility of early lactating dairy cow, Buletin Peternakan 33 (2): 81-87.

Baba, S., A. Muktiani, A. Ako, A. Sanusi, dan I.A. Dagong. 2012. Produksi *Complete Feed* Berbahan Baku Lokal dan Murah Melalui Aplikasi Participatory.

Bakara O, Santoso L dan Heptarina D. 2012. Enzim Mananase dan Fermentasi Jamur untuk Meningkatkan Kandungan Nutrisi Bungkil Inti Sawit pada Pakan Ikan Nila BEST (Oreochromis niloticus). Jurnal Ilmu Perikanan dan Sumberdaya Perairan. (3) : 69-72.

Batan IW. 2002. Sapi Bali Dan Penyakitnya. Fakultas Kedokteran Hewan Universitas Udayana. Denpasar.

Budiman, A., T. Dhalika, B. Ayuningsih. 2006. Uji kecernaan serat kasar dan bahan ekstrak tanpa nitrogen (BETN) dalam ransum lengkap berbasis hijauan daun pucuk tebu (Saccharum officanirum). Jurnal Ilmu Ternak 6(2): 132-135

Burke, J.M., C.R. Staples, C.A. Risco, R.L. De La Sota, and W.W. Thatcher. 1997. Effect of feeding a ruminant grade Manhaden fish meal on reproductive and productive performance of lactating dairy cows. J. Dairy Sci. 80 : 3386- 3398.

Darmadja SDND. 1980. Setengah Abad Peternakan Sapi Tradisional dalam Ekosistem Pertanian di Bali. (Disertasi). Universitas Padjadjaran. Bandung.

Derrick, B., B. Rush, D. Toher, dan P. White. 2017. Test statistics for the comparison of means for two samples that include both paired and independent observations. Journal of Modern Applied Statistical Methods 16(1): 137-157

Deutschmann, K., C. Phatsara, C. Sorachakula, T. Vearasilp, W. Phunphiphat, A. Cherdthong, K. Gerlach and K.H. Sűdekum. 2017. In vitro gas production and in vivo nutrient digestibility and growth performance of thai indigenous cattle fed

fresh and conserved pangola grass. Italian Journal of Animal Science 16(3): 521–529.

Diputro, Faris. 2008. Efek Berbagai Pakan Komplit terhadap Daya Cerna Bahan Kering dan Protein Kasar pada Sapi Perah. Skripsi. Fakultas Kedokteran Hewan Universitas Airlangga. Surabaya.

Dismawan, I. Wayan Heri, I. Ketut Ginantra and Ni Luh Suriani. 2014. Seleksi jenis tumbuhan pakan dan kandungan nutrien jenis tumbuhan yang dimakan sapi bali (*Bos sondaicus*) lepas sapih di daerah bukit badung selatan, kabupaten Badung, Bali. Jurnal Simbiosis II(2): 192–202.

Ensminger, M. E.1991. Animal Science. 9th Edition. Interstate Publisher, Inc. Danville, Illi ois

Farida, W. R., A. P. Sari, N. Inayah dan H. A. Nugroho. 2017. Analisis kebutuhan nutrien dan efisiensi penggunaan pakan bubur formulasi pada oposum layang (Petaurus breviceps Waterhouse, 1839). J. Biologi Indonesia. 13 (2): 305 – 314.

Ginting, S.P. 2009. Prospek penggunaan komplit pada kambing: tinjauan manfaat dan aspek bentuk fisik pakan serta respon ternak. Wartazoa Vol. 19 No: 64 -75

Guntoro, S. 2006. Membudidayakan Sapi Bali. Penerbit Kanisius, Yogyakarta.

Hadi, R. F., Kustantinah, dan H. Hartadi. 2011. Kecernaan In Sacco hijauan leguminosa dan hijauan non leguminosa dalam rumen sapi Peranakan Ongole. Buletin Peternakan 35(2): 79 – 85.

Handajani, H., 2012. Optimalisasi substitusi tepung Azolla terfermentasi pada pakan ikan untuk meningkatkan produktivitas ikan nila gift. Jurnal teknik industri, 12(2), pp.177-181.

Handiwirawan E. 2003. Penggunaan Mikrosatelit HEL 9 dan INRA 035 Sebagai Penciri Khas Sapi Bali. (Tesis). Program Pascasarjana. Institut Pertanian Bogor. Bogor.

Hartadi, H. S, Reksohadiprodjo. dan A. D, Tillman. 1990. Tabel Komposisi Pakan untuk Indonesia. Gadjah Mada University. Yogyakarta.

Kondo, M., M. Yoshida, M. Loresco, M. L. Lapitan, J. Rommel, V. Herrera, A. N. D. Barrio, Y. Uyeno, H. Matsui and T. Fujihara. 2015. Nutrient contents and in vitro ruminal fermentation of tropical grasses harvested in wet season in the Philippines. Advances in Animal and Veterinary Sciences 3(12): 694–699.

Lalujan LE, Suhartati Djarkasi GS, Thelma JN, Tuju, Dekie Rawung, Maria F. Sumual. 2017. Komposisi kimia dan gizi jagung lokal varietas manado kuning sebagai bahan pangan pengganti beras. J Tek Pertanian 8(1): 47-54.

Mandell, I.B., J.G. Buchanan-Smith, B.J. Halub, and C.P. Campbell. 1997. Effects of fish meal in beef cattle diets on growth performance, carcass characteristics, and fatty acid composition of longissimus muscle. J. Anim. Sci. 75: 910- 919.

Marzuqi, M. and Anjusary, D.N., 2013. Kecernaan nutrien pakan dengan kadar protein dan lemak berbeda pada juvenil ikan kerapu pasir (Epinephelus corallicola). Jurnal Ilmu dan Teknologi Kelautan Tropis, 5(2), pp.311-323.

Mathius, I. W., D. Yulistiani dan W. Puastuti. 2002. Pengaruh Substitusi Protein Kasar dalam Bentuk Bungkil Kedelai Terproteksi Terhadap Penampilan Domba Bunting dan Laktasi. JITV 7 (1): 22 – 29.

Maynard, L.A., J. K Loosil, H. F. Hintz and Warner, R.G., 2005. Animal Nutrition. McGraw-Hill Book Company. New York, USA.

Mayulu, H., Maulida, N., Yusuf, R., Rahmatullah, S.N., 2018. Effect of production cost on revenue of swamp buffalo farm business (Bubalus bubalis Linn.) in Hulu Sungai Utara Regency South Kalimantan Province. Jurnal Teknologi Pertanian Universitas Mulawarman, 13(2), 58-64.

McDonald, P. R., A. Edwards, J. F. D. Greenhalg dan C. A. Morgan. 2002. Animal Nutrition 6th Edition. Longman Scientific and Technical Co. Published in The United States with John Willey and Sons Inc, New York.

Muladno. 2012. Aplikasi Teknologi Perbibitan untuk Peningkatan Produksi Bakalan dan Kualitas Daging Sapi Nasional. Proc. Seminar Nasional Peningkatan Produksi dan Kualitas Daging Sapi Bali Nasional. Bali, 14 September 2012.

Noersidiq, A. 2015. Pengaruh Pemberian Tepung Kulit Nanas Yang Diberi Fermentasi Dengan Yoghurt Terhadap Retensi Bahan Kering, Protein Kasar dan Kecernaan Serat Kasar Pada Ayam Broiler Fase Awal. Skripsi. Fakultas Peternakan Universitas Jambi.

Palmquist, D.L., and D.J. Kinsey. 1994. Lypolysis and biohydrogenation of fish oil by ruminal microorganisms. J. Dairy Sci. 77. Supplement 1 : 350-357.

Paramita, W., W. E. Susanto dan A. B. Yulianto. 2008. Konsumsi dan kecernaan bahan kering dan bahan organik dalam haylase pakan lengkap ternak sapi Pernakan Ongole. J. Media Kedokteran Hewan. 24 (1) : 59 – 62.

Perry, TW, AE Cullison, and RS Lowrey. 2005. Feeds and Feeding. 6th Ed. Prentice Hall of Upper Saddle River. New Jersey.

Pike, I.H., E.L. Miller, and K. Short. 1994. The role of fish meal in dairy cow feeding. IFOMA Technical Bulletin 27 (August 1994). IFOMA, St Albans, Hertfordshire, UK.

Preston, T. R. dan R. A. Leng. 1987. Matching Ruminant Production System with Available Resources in Tropics and Sub-Tropics Panambul Book, Armidale. Australia.

Purnamasari, E., I.G. Bambang dan N.A. Andi. 2006. Potensi dan pemanfaatan bahan baku produk tepung ikan. EPP.Vol 3 No.2:1-7

Sanchez. C. (2009). Lignocellulosic residues: biodegration and bioconversion by fungi. Biotechnol. Advan, (27), 185-19.

Sandri, A. 2009. Suplementasi Blok Multinutrisi Berbasis Hijauan Lapangan terhadap Kecernaan In Vivo pada Domba Jantan. Departemen Peternakan, Fakultas Pertanian, Universitas Sumatera Utara, Medan.

Ilmu Makanan Ternak Dasar. Gadjah Mada University Press. Yogyakarta.

Tilman, A.D., Hartadi, H., Reksohadiprodjo, S., Prawirokusumo, S. dan Lebdosoekodjo, S., 1989. Ilmu Makanan Ternak Dasar. Cetakan ke 4. Gajah Mada University Press. Yogyakarta.

Toharmat, T., E. Nursasih, R. Nazilah, N. Hotimah, T. Q. Noerzihad, N. A. Sigit dan Y. Retnani. 2006. Sifat Fisik Pakan Kaya Serat dan Pengaruhnya Terhadap Konsumsi dan Kecernaan Nutrien Ransum Pada Kambing. Media Peternakan. 29 (3). Pp. 146 - 154.

Tulung, Y.L.R., A.F. Pendong, B. Tulung. 2020. Evaluasi nilai biologis pakan lengkap berbasis tebon jagung dan rumput campuran terhadap kinerja produksi sapi Peranakan Ongole (PO). Zootec 40(1): 363 – 379.

Utari F.D, Prasetiyono B.W.H.E, dan Muktiani A. 2012. Kualitas susu kambing peranakan Ettawa yang diberi suplementasi protein terproteksi dalam wafer pakan komplit berbasis limbah agroindustri. Animal Agriculture Journal, 1 (1): 427-441.

Wahyuni, I. M. D., A. Muktiani., dan M. Christiyanto. 2014. Kecernaan Bahan Kering dan Bahan Organik dan Degrabilitas Serat pada Pakan yang Disuplementasi Tanin dan Saponin. Agripet. 14(2): 115-124.

Widya, P.L., W.E. Susanto, A.B. Yulianto. 2008. Konsumsi dan kecernaan bahan kering dan bahan organik dalam haylase pakan lengkap ternak sapi Peranakan Ongole. Jurnal Media Kedokteran Hewan 24(1): 59 – 62.

Widyastuti, D.A., 2011. Kecernaan Bahan Kering dan Bahan Organik pada Hijauan Arachis hipogaea Dalam Pertanaman Tumpang Sari Arachis hipogaea – Zea mays saccharata dengan Inokulasi Rhizobium pada Tanah Bekas Legume. Skripsi. Program Studi Pendidikan Biologi IKIP PGRI Semarang. 124 hal.

Wijayanti, E., F. Wahyono dan Surono. 2012. Kecernaan nutrien dan fermentabilitas pakan komplit dengan level ampas tebu yang berbeda secara in vitro. Anim. Agric. J. 1 (1) : 167 – 179.

Williamson G dan Payne WJA. 1993. Pengantar Peternakan Di Daerah Tropis. Universitas Gajah Mada. Yogyakarta

Wina, E dan Susana. 2013. Manfaat Lemak Terproteksi Untuk Meningkatkan Produksi dan Reproduksi Ternak Ruminansia. Wartazoa. Bogor. 23(4): 176-184.

Winugroho, M., Suharyono, and Y. Widiawati. 2007. The effect of feeding Multi-nutrient Feed Supplement (MFS) and legor on PO cattle productivity. Proc. Seminar Nasional Teknologi Peternakan dan Veteriner. Bogor, 21–22 Agustus 2007

Wiseman, J. 1990. Variability in the Nutritive Value of Fast For Ruminant. In: Feedstuff Evaluatrion. Wiseman, J. And D.J.A. Cole (Eds). Butterworths pISSN 0852 – 2626 eISSN 2615 – 8698

Xu, Chuncheng, Y. Cai, N. Moriya and M. Ogawa. 2007. Nutritive value for ruminants of green tea grounds as a replacement of brewers' grains in totally mixed ration silage. Anim. Feed Sci. Technol. 138: 228.

Yudono, B. F. Oesman, dan Hermansyah. 1996. Komposisi asam lemak sekam dan dedak padi. Majalah Sriwijaya. 32 (2) 8-11.