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Short Biography

Dr. Asif Ahmad holds a PhD degree in Food Technology and have vast teaching and research experience in discipline of Food science, Agriculture and Nutrition. While working with team of researchers, he got international research experience in USDA labs, OARDC and Ohio state university in USA. He is member of many scholastic societies working in field of Food Science and Nutrition. He is serving on Editorial boards of several journals in his field. Authorship of two books, eight book chapters and more than 55 Research articles make it prominent in his field. Supervision of about 35 Masters level and five PhD level dissertations are on his record. His research on nutraceutical foods, bioactive compounds and dietary fiber has published in international journals of repute. He devised some low-cost techniques for extraction of dietary fibers using indigenous resources. On his credit, there are several National and international awards including prestigious Fulbright fellowship. Currently, he is working as Professor (Food technology) with PMAS-Arid Agriculture University Rawalpindi, Pakistan.

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Abstract

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Keywords

corn straw, fermentation, digestibility, crossbreed chicken

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Digestibility of Crude Protein, Crude Fiber and Metabolic Energy of Rations Containing Corn Straw Fermentation in Cross Breed Chicken

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Abstract

This study was conducted to determine the digestibility of crude protein, crude fiber and metabolizable energy diet containing corn straw fermentation super chicken. The material used is corn straw, basal feed, chicken super 8 weeks old adult male. The method used is the method of a field experiment with five treatments and five replications, so that there are 25 experimental units. Each experimental unit consisted of one super chicken, and the number of chickens used were 25 animals, were conducted using the total collection of excreta. Feed The experiment was arranged on 5 kinds of feed treatment consisted of five chickens for each treatment. Feed given trial is the percentage of corn straw unfermented (JJ) and maize straw fermented (JJF) five treatments such feed is composed of P0 = feed Basal, P1 = 90% feed Basal + 10% HH, P2 = 90% feed Basal + 10% JJF, P3 = 80% + 20% Basal Feed JJ, P4 = 80% + 20% Basal Feed JJF. The variables measured were the digestibility of crude protein, crude fiber and metabolizable energy. The collected data analysis of variance with the pattern of RAL and analyzed using the Duncan test. The results showed that the diet containing corn straw fermentation in P2 treatment improved the digestibility of protein, crude fiber and metabolizable energy. Fermented corn straw proved to improve the digestibility of crude protein,

Keywords*: corn straw, fermentation, digestibility, crossbreed chicken*

Introduction

Corn straw is a byproduct of farming corn with production levels of 4-5 tonnes/ha.The content of nutrients such as protein maize straw 5.56%, 33.58% crude fiber, 1,25 crude lipid, ash 7.28 and BETN 52.32% (BPTP Sumatera Barat, 2011). Data The above shows that the main constraints of use agricultural crop residues, including corn, the feed is particularly low nutritional value, the high content of crude fibre and gynecology low protein. High crude fibre content causes low digestibility of plant waste corn. Efforts to overcome the limitations of waste the corn crop is by treating before being fed to cattle or through the process; thus, preserving the nutritional content can improve. According to Hana (2008) that for improving the nutritional value of forage common done is by making it into forage dried (hay), the addition of urea (amoniacal), and preserved forage (silage). Furthermore Kartasujana (2001) stated that the silage comes from forage food livestock or agricultural waste is preserved in fresh state (with a water content of 60-70%) through the process of fermentation in the silo (place-making silage), while ensilage is the process of making silage.

Yuniarsih and Nappu (2013) quote from Lab analysis results. Chemical Feed Unhas (2012) that nutrient content of corn straw (leaves) is a protein rough 5.80%, 27.38% crude fibre, crude lipid 2.90% and ash 20,8.21%. Hidayat (2014) found that with good withering (forage moisture content ± 60%), the use of additives drops to the level of 1-3% and katul levels 5-15 can maintain characteristics and nutritional value of grass silage king compared to the use of cassava 5-15 percent. Corn straw is a byproduct of farming corn with production levels of 4-5 tonnes/ha. The content of nutrients such as protein maize straw 5.56%, 33.58% crude fiber, 1,25 crude lipid, ash 7.28 and BETN 52.32% (BPTP Sumatera Barat, 2011). Data The above shows that the main constraints of use agricultural crop residues, including corn the feed is particularly low nutritional value the high content of crude fibre and low gynaecology protein. High crude fibre content causes low digestibility of plant waste corn. Efforts to overcome the limitations of waste the corn crop is by treating before being fed to cattle or through the process: thus, preserving the nutritional content can improve.

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Corn straw is a by-product of corn plants. Potential large enough corn straw could reach 4-5 tons/ha. The nutritional content of corn straw pretty good, consisting of 6.38% crude protein, crude fiber 30.19%, 2.81% crude lipid, BETN 51.69%, ash content of 8.94% and 53.12% TDN (Bahar, 2016). According Nursiam (2010) nutrient content of corn straw (leaves) is 4.77% crude protein, crude fiber 30.53%, 1.06% crude lipid and ash 8.42%, while according to Bahri (2018) that for corn straw the age of 90 days had a crude protein content of 6.53 34.08% crude fiber, crude lipid 1.68%, BETN 45.05% and 12.66% ash. Corn straw can be used as an alternative feed ingredient considerable potential. Utilization is one solution that can be done to reduce feed costs while maintaining nutrient content and the availability of such waste when used as animal feed. The Crude fiber content of corn straw which is well above 30% and low protein content of corn straw becomes a limiting factor to be used as feed for poultry birds due to very low palatability. Efforts to improve the nutritional value that can be done by making use of fungi in the fermentation process using Trichoderma viride. The Crude fibre content of corn straw which is well above 30% and low protein content of corn straw becomes a limiting factor to be used as feed for poultry birds due to very low palatability. Efforts to improve the nutritional value that can be done by making use of fungi in the fermentation process using Trichoderma viride. The Crude fiber content of corn straw which is well above 30% and low protein content of corn straw becomes a limiting factor to be used as feed for poultry birds due to very low palatability. Efforts to improve the nutritional value that can be done by making use of fungi in the fermentation process using Trichoderma viride.

Fermentation is a process that involves an anaerobic microbial activity that takes place using the specific substrate and produces a higher-value product (Mirwandhono et al., 2006). Trichoderma viride produce cellulase enzymes capable of overhauling cellulose and hemicellulose that will reduce levels of crude fiber and increase the crude protein. It is expected that the fermentation process can improve the digestibility and improve the availability of energy that can be utilized in the ration chicken super. The content of crude fiber in the diet will affect the digestibility of proteins and another organic material other than that digestibility is one of the factors that influence metabolic energy feedstuffs.

Based on this background, the research on the use of fermented corn straw in the ration chicken super against the digestibility of crude protein, crude fiber and metabolizable energy. The research objective was to determine the level of use of fermented corn straw in the ration chicken super against digestibility of crude protein, crude fiber digestibility and metabolizable energy value.

Material and Methods

Research conducted in the laboratory of the faculty of Agriculture farm Gorontalo State University in June-July 2018. The research material used in this research that corn straw, basal feed, chicken super 8 weeks old adult male. The Feed is based on the needs of super chicken food substances. Livestock experiment using chicken super-aged 8 weeks are male as many as 25 animals. Individual metabolic cages the size of 45 x 35 x 50 cm equipped where to eat, where to drink and a plastic tray container excreta. The Basal feed used is a broiler concentrate, corn and rice bran. To weigh and chicken feed used Krisbow electronic scales kitchen scale type KW06-623 capacity of 5 kg / 11 lb with the level of accuracy of 1g / 0:05 oz. Other equipment used in plastic to store samples of feed and excreta shelters, hygiene kits consisting of a broom, rag and bucket, disinfectant spray, thermometer, hygrometer and stationery. The method used is the method of field trials using adult chicken super 8 weeks old with 5 treatments and 5 replicates, so there are 25 experimental units. Each experimental unit consisted of one super chicken, and the number of chickens used were 25 animals, were conducted using the total collection of excreta. Feed The experiment was arranged on 5 kinds of feed treatment consisted of five chickens for each treatment. Feed the experiment are: hygrometer and stationery. The method used is the method of field trials using adult chicken super 8 weeks old with 5 treatments and 5 replicates, so there are 25 experimental units. Each experimental unit consisted of one super chicken, and the number of chickens used were 25 animals, were conducted using the total collection of excreta. Feed The experiment was arranged on 5 kinds of feed treatment consisted of five chickens for each treatment. Feed the experiment are: hygrometer and stationery. The method used is the method of field trials using adult chicken super 8 weeks old with 5 treatments and 5 replicates, so there are 25 experimental units. Each experimental unit consisted of one super chicken, and the number of chickens used were 25 animals, were conducted using the total collection of excreta. Feed The experiment was arranged on 5 kinds of feed treatment consisted of five chickens for each treatment. Feed the experiment are: was conducted using a total collection of excreta. Feed The experiment was arranged on 5 kinds of feed treatment consisted of five chickens for each treatment. Feed the experiment are: was conducted using a total collection of excreta. Feed The experiment was arranged on 5 kinds of feed treatment consisted of five chickens for each treatment. Feed the experiment are:

1. P0 = Feed basal
2. P1 = 90% + 10% basal Feed JJ
3. P2 = 90% + 10% basal feed JJF
4. P3 = 80% + 20% basal Feed JJ
5. P4 = 80% + 20% basal feed JJF

Basal feed composed of 52% milled yellow corn, 38% concentrate and 10% rice bran broiler. Corn and corn straw fermentation an appropriate level of treatment. Feed protein content ranged from 18.52 to 21.232% and Metabolic Energy ranging from 2723.68 to 3012.1 Kcal/kg

Parameters measured at the research stage are:

1. Apparent metabolizable energy (Apparent Metabolizable Energy = AME). Digestibility test for determinants of metabolic energy by methods Farrel (1978) as follows:

$$AME = \frac{(AxB) - (CXD)}{A} \times \frac{100}{BK}$$

Where :

AME Ev = Metabolic Energy (kcal / kg)

A = The amount of feed consumed (g)
B = Feed gross energy (kcal / kg)
C = Number of excreta (g)
D = Gross energy of excreta (kcal / kg)
BK = Dry matter (%)

2. Feed digestibility test against Coarse Protein is a protein percentage of feed that can be digested. Protein digestibility was calculated by the formula, according to McDonald et al. (1995).

$$\text{Digestibility Protein} = \frac{\text{Consumption of Protein-Protein excreta}}{\text{Protein consumption}} \times 100\%$$

Where :
protein consumption = (% Protein consumption BK) x% PK feed
PK in excreta = (Σ excreta% BK) x% PK excreta
PK = Crude protein
BK = Dry matter

3. The Crude fiber digestibility (%) is a crude fiber can be digested calculated from crude fibre content of feed consumed reduced by the coarse fibre content of excreta multiplied by 100%.

Metabolizable energy testing procedures as follows: testing of metabolizable energy using the chicken super-aged 8 weeks are male. Chickens reared for two weeks with the details of seven days of adaptation (Farell, 1978) and three days for data collection. Individually chickens are placed in battery cages suitable for the determination of metabolizable energy, i.e. with a length of 45 cm, width 35 cm and height 50 cm made of wire, and is equipped with the feeding and drinking places are designed to reduce spillage of feed as small as possible, so that they can spend on food at 100 g/head/day for one hour. The experiment lasted for 3 days; the first-day chickens have fasted for 32 hours. Excreta container tray lined with a plastic sheet, and a tray a little bit drawn out during the feeding takes place, then pushed into the tray so that all the excreta can be accommodated. Excreta collection was performed for 42 hours. Feathers and scales that go into the tray should be discarded. After 42 hours the plastic container along with the excreta is dried in an oven at a temperature of 60 ° C for 24 hours, or if chicken manure too wet then the plastic together traynya can be directly inserted in the oven and dried for 48 hours. Dried excreta has taken the plastic, are left in the open air for 3 hours, then weighed the dry weight of excreta and milled for analysis. Feathers and scales that go into the tray should be discarded. After 42 hours the plastic container along with the excreta is dried in an oven at a temperature of 60 ° C for 24 hours, or if chicken manure too wet then the plastic together traynya can be directly inserted in the oven and dried for 48 hours. Dried excreta has taken the plastic, are left in the open air for 3 hours, then weighed the dry weight of excreta and milled for analysis. Feathers and scales that go into the tray should be discarded. After 42 hours the plastic container along with the excreta is dried in an oven at a temperature of 60 ° C for 24 hours, or if ekskretanya too wet then the plastic together traynya can be directly inserted in the oven and dried for 48 hours. Dried excreta has taken the plastic, are left in the open air for 3 hours, then weighed the dry weight of excreta and milled for analysis.

Data analysis

Data were analyzed by analysis of variance (ANOVA) of a completely randomized design (CRD) with 5 treatments with 5 replicates. If there is any difference between the effect of the treatment was followed by Duncan's Multiple Range Test (Duncan's Multiple Range Test) to parameters that differ significantly between treatments. Tabulation of data and data analysis was performed according to procedures Steel and Torrie (1997). Data analysis was performed according to the 14th Edition GENSTAT program. The mathematical model of variance RAL is:

$$Yijk = \mu + \alpha i + € ijk$$

Where :
Yijk = the observed values

μ = the midpoint population
αi = effect of the ith treatment
€ ijk = effect of the error
i = 1,2,3 ...
j = 1,2,3 ...

Results and Discussion

Digestibility of crude protein

According to the research, the highest crude protein digestibility in treatment P0 (82.27%) followed by treatment P2 (84.40%) and P1 (81.97%) and treatment markedly decreased P3 and P4 (table1). The higher the percentage of corn straw in the ration provides a highly significant difference (P <0.01) in the digestibility of crude protein. Duncan test results showed that the treatment P0, P1 and P2 are not different, but the treatment P3 and P4 very markedly decreased. This suggests the use of fermented corn straw up to 10% in the feed gave the same response to the protein digestibility. Increased corn straw feed fermentation in lowering the digestibility of crude protein.

Table 1. Crude protein digestibility value of ration containing fermented corn straw on the chicken super

repeat	Treatment 1)				
	P0	P1	P2	P3	P4
1	85.71	82.74	85.26	73.22	60.10
2	81.54	82.15	85.09	77.31	69.22
3	82.55	84.52	82.78	76.73	57.97
4	89.26	82.81	83.13	78.12	60.66
5	87.27	77.64	85.74	75.33	64.39
Average	85.27[a]	81,97a	84.40[a]	76,14b	62.47[c]

Description: 1) P0 = 100% Feed Basal without fermented corn straw; P1 = P0 + 90% 10% JJF; P2 = 90% + 10% JJF P0; P0 P3 = 80% + 20% JJ; P0 P4 = 80% + 20% JJF
2) Different letters on the same line showed a highly significant difference (P <0.01)

Crude protein digestibility greatly depends on protein livestock feed. Rations with high protein content have a high digestibility or otherwise. High and low digestibility of the protein is affected by the protein content of the feed material (Tilman et al. 2005). Poultry protein digestibility ranged between 70-85% (Rev. 2004). Anggorodi (1995) stated that based on the digestibility of the quality of the ration is divided into three categories, 1) low quality if the value of digestibility in the range of 50-60%, 2) the quality of being in the range of 60-70%, 3) and digestibility of over 70 % high quality. The value digestibility of crude protein on the results of the P0, P1 and P2 are relatively equal due to the protein content of the ration at relatively the same ration. This situation proves that the use of fermented corn straw in the ration to the level of 10% in the same effect as good as corn ration without containing straw fermentation of crude protein digestibility value. This is because the crude protein ration of treatment does not differ much and corn straw degradation of proteins by the activity of fungi in the fermentation process into components that are easily digested, namely peptides and amino acids. Widodo et al. (2013) stated that the level of feed digestibility value depends on the amount of protein that enters the digestion and feed ingredients making up rations. This is because the crude protein ration of treatment does not differ much and corn straw degradation of proteins by the activity of fungi in the fermentation process into components that are easily digested, namely peptides and amino acids. Widodo et al. (2013) stated that the level of feed digestibility value depends on the amount of protein that enters the digestion and feed ingredients making up rations. This is because the crude protein ration of treatment does not differ much and corn straw degradation of proteins by the activity of fungi in the fermentation process into components that are easily digested, namely peptides and amino acids. Widodo et al. (2013) stated that the level of feed digestibility value depends on the amount of protein that enters the digestion and feed ingredients making up rations. The less amount of crude protein is wasted along with the excreta digestibility of crude protein will be higher. Winedar et al. (2006) found that the amount of crude protein consumed will affect the digestibility of crude protein.

Crude fibre digestibility

Crude fibre digestibility by analysis of variance showed that the use of fermented corn straw in the same effect between treatment P0, P1 and P2 (33.95%, 28.20% and 32.34%) So that the digestibility of crude fibre does not experience any difference (Table 2). This shows that the use of fermented corn straw up to 10% gave the same response to the value of crude fibre digestibility. The Crude fibre content of the ration treatment P0, P1 and P2 respectively4.38%, 6.44%, 5.93% showed the same results, so that the digestibility of crude fibre does not experience any difference, compared to the treatment P3 and P4 very markedly decreased respectively by 8:50% and 7.47% (Table 2).

Table 2. Crude Fiber digestibility value of ration containing fermented corn straw on the chicken super

repeat	Treatment 1)				
	P0	P1	P2	P3	P4
1	24.43	24.16	30.04	20.36	18.17
2	25.30	39.97	34.47	32.04	23.36
3	25.91	24.35	29.08	20.52	15, 97
4	54.36	26.98	30.46	25.05	16, 25
5	38.73	25.59	37.65	24.29	13, 46
Average	33.95^{a}	28,20a	32,34a	24.45^{ab}	17.44^{b}

Information :1) P0 = 100% Feed Basal without fermented corn straw; P0 P1 = 90% + 10% JJ; P2 = 90% + 10% JJF P0; P0 P3 = 80% + 20% JJ; P0 P4 = 80% + 20% JJF
2) Different letters on the same line showed a highly significant difference (P <0.01)

Amrullah (2006) states that the coarse fibers in broilers between 5% - 6%. The Crude fiber content of feed used in this study ranged between 4.38% - 6.14%. Tillman et al. (2005) suggest that the digestibility of crude fibre depends on the content of crude fiber in the diet and the amount of crude fibre consumed. Prawitasari et al. (2012) state that the higher the content of crude fiber in the diet will lead to an increasingly lower digestibility of crude fiber and vice versa. The Crude fiber components in the feed provide enormous influence on digestibility, the amount and composition. Cell content of fibrous feed almost everything can be digested, but the cell walls are composed of cellulose and hemicellulose are very difficult to digest because it contains a high lignin (McDonald et al., 1995). Some of the factors that affect the digestibility of crude fiber include fiber content in feed and the composition of the constituent crude fibre (Maynard et al. 2005). The range of values of crude fiber digestibility in poultry between 20-30% (Supriyatna, 2010). Poultry has limitations in digesting crude fiber because it can not produce the enzyme cellulase; thus overall crude fiber can carry food substances that can be ingested out with faeces (McDonald et al. 2010).

Metabolizable energy

Metabolic energy Mean on super chicken ranges 1902.61 kcal/kg to 2899.13 Kcal/kg. The highest Metabolic energy value obtained in treatment P0, followed by P2, P1, P3 and P4 (Table 3). Results of analysis of variance showed that the use of fermented corn straw in the ration chicken super show a highly significant difference (P <0.01) against the metabolizable energy value. P3 treatment that uses corn straw 20% unfermented cause real metabolizable energy value decreased compared to the P0, P1, P2 and P4.Duncan test showed that the treatment P0, P1, P2 and P4 are no different, but very real P3 treatment decreased. This indicates that all four treatments have the same effect on energy digestibility. But there is a tendency P2 treatment increased energy value. This shows that the use of fermented corn straw up to 10% in the ration chicken super gave a good response to the metabolizable energy digestibility.

Table 3. Metabolic energy value rations containing corn straw fermentation in the chicken super

repeat	Treatment[1)]				
	P0	P1	P2	P3	P4
1	2956.99	2690.85	2948.26	2966.21	1864.16
2	2814.2	2911.27	2948.26	2812.80	2453.36
3	2601.42	2694.29	2869.51	2622.68	1968.54
4	3076.40	2684.71	2872.53	2823.82	1890.71
5	2916.84	2701.01	2955.30	2665.95	2004.81
Average	2873,17a	2736.29[a]	2918.77[a]	2036.32[b]	2778.28[a]

Description: 1) P0 = 100% Feed Basal without fermented corn straw; P1 = P0 + 90% 10% JJ; P2 = 90% + 10% JJF P0; P0 P3 = 80% + 20% JJ; P0 P4 = 80% + 20% JJF

2) Different letters on the same line showed a highly significant difference (P <0.01)

The decline in the value of metabolizable energy at P3 treatment (20% using corn straw unfermented) allegedly due to high crude fiber content in the ration so that the absorption of nutrients is not optimal, especially the absorption of energy in the ration is low. Jimenez et al. (2013) stated that increasing the amount of crude in the diet causes retention of organic matter, dry matter and nitrogen.

High crude fiber content greatly affects the digestibility of feedstuffs. As stated Anggorodi (1994) that the higher crude fiber contained in the feed material thicker cell walls, resulting in the low digestibility of foodstuffs. Digestibility of some foodstuffs closely linked to the composition of nutrients, so the crude fiber content can affect the digestibility (Tillman et al. 1991). Biological metabolic energy yield was higher than the metabolizable energy of feed because the feed has undergone a process of digestion in the body of animals (Sugiyono, 2015)

Conclusion

Based on the results of this study concluded that the use of fermented corn straw ration super chicken with different levels could increase the digestibility of crude protein, crude fiber and metabolizable energy at the level of 10% increase.

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