The Use of Manure from Cattle Fed Different Level of Concentrate for *Musa domestica* Larvae Production and Its Utilisation as Chicken Feed

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ABSTRACT

Utilizing cattle manure for house fly larvae production before composted may provide additional income for cattle farmer since larvae can be used as chicken feed. Larvae production, however, is highly dependent upon the quality of cattle manure. Two consecutive experiments have been conducted with the purpose to investigate : 1) the use of manure from cattle fed two levels of concentrate with or without combination of other growth media for house fly larvae production, and 2) the effect of feeding different levels of house fly larvae on egg production of native chicken. In the 1st experiment, as many as 12 Ongole heifers weighing 236 ± 17 kg were grouped into two groups of six heifers to receive either 1 or 2% BW of concentrate containing 15 CP. Manure from each heifer was then used as growth media for house fly larvae with or without combination either with chicken manure or discarded fish cut. Larvae production was recorded and thereafter used as chicken feed in the 2nd experiment in increasing level of larvae proportion in the diet, i.e. 0, 5, 10, 15 and 20% of the total feed offered to five groups of 20 native chicken. The basal feed was commercial complete feed for layer given after larvae was completely consumed. Egg production and weight were recorded. Result showed that larvae production was in the range 10.23-18.01g per kg manure and manure from Ongole cattle fed both 1 or 2% BW were not improved ($P>0.05$) when combined with discarded fish cut and significantly reduced ($P<0.01$) when combined with chicken manure. Egg production and weight did not differ ($P>0.05$) with the inclusion of larvae in the diet up to 15%, but reduced at 20%. It can be concluded that manure of concentrate-fed Ongole cattle can be used as growth media for house fly larvae without a need to be combined with other growth media and the larvae produced is prospective to replace as much as 15% of commercial feed for layers.

Keywords: Native chicken, Egg production, Manure quality

INTRODUCTION

Feeding concentrate feed to local cattle during fattening period improve weight gain and shorten fattening period, hence its use should be promoted to boost beef cattle production in Indonesia. The economic benefit of using concentrate feed, however, has been hindered by its reasonably high price making limited adoption among small farmers. In order to spread among small tenant farmer, feces from concentrate fed animals should be utilized to produce additional income. Its utilization as a media for house fly larva production that can be used as chicken feed promises additional income and wide spread of concentrate feeding among farmers.

The use of house fly larvae as chicken feed has been studied recently by Ogunji *et al.* (2006), Agunbiade *et al*. (2007), and among other researcher and in general house fly larvae and pupa has high nutritive value especially for its high protein content potentially to replace fishmeal as well as other conventional protein sources (Veldkamp *et al.*, 2012; Vantomme., 2015). Compared to common protein source like soybean or sun flower cakes, house fly larvae contain higher and more balanced amino acids. It is also rich in histidin and methionine content, and contains no chemical substances toxic to animal (Makkar *et al.*, 2014; Charton *et al.*, 2015). Larvae production, however, is highly dependent upon growth media. The objectives of this experiment were to investigate the production *Musca domestica* larvae utilizing manure from Ongole cattle fed different level of concentrate with or without addition of chicken manure or discarded fish cut and to study the effect of inclusion of increasing level of house larvae on egg production of native chicken.

MATERIALS AND METHODS

Two consecutive experiments were conducted to investigate the use of manure from cattle fed two levels of concentrate with or without combination with either chicken manure or discarded fish and the effect of feeding different levels of housefly larvae on egg production of native chicken. In the 1st experiment, twenty Ongole cattle were randomly divided into two groups of ten cattle and they were fed corn silage basal diet supplemented with concentrate either at 1% and 2% of Body weight respectively. The manure from both groups was collected daily and freshly used as a growth media for *Musca domestica* larvae either used alone or combined with chicken manure or discarded fish. The combination was 75% cattle manure : 25% chicken manure or discarded fish at dry matter bases. Ten replication of each treatment were placed in a 40x40 cm2 wood box. Those boxes were left for one day to provide sufficient time for housefly to lay eggs. At day 3, larvae was collected and weighted. Samples were taken for dry matter and chemical analyses.

Based on the result of the 1st experiment, the 2nd experiment was run using house fly larvae that was produced using cattle manure and discarded fish cut at 75:25% ratio. Larvae growth media was made daily and larvae was harvested at day-3, therefore there was similar age of larvae that was given to chicken every day. Larvae was offered at 0, 5, 10, 15 and 20% of the total feed at dry matter bases per day to each group of 20 native chicken. The basal feed was a commercial complete feed for layer, i.e. 324K by PT Charoen Phokphand Indonesia, and given after larvae was completely consumed. Parameters measured included chemical composition of cattle manure, feed intake and egg production.

Data collected were analyzed using Proc GLM using SPSS 18 software for any interaction as well as main effect.

RESULTS AND DISCUSSION

Larvae Production

The result of this experiment showed that there was no interaction ($P>0.05$) between source of manure and the combination between cattle manure and either chicken manure or discarded fish cut in their effect on larvae production. Therefore data were presented in terms of the effect of source of cattle manure and its combination with chicken manure and discarded fish cut as main factors. Larvae production and the quality of cattle manure from Ongole cattle fed corn silage supplemented with concentrate at a level of 1 or 2% BW is

presented in Table 1. Meanwhile, the effect of the combination between cattle manure and chicken manure or discarded fish cut as larvae growth media on larvae production is presented in Table 2.

Table 1. Chemical composition of Ongole cattle fed different level of concentrate as the subsequent larvae production and its chemical composition

Variables	Level of Concentrate		**SEM**	**P-value**
	1%BW	2%BW		
Cattle manure chemical composition :				
Dry matter (%)	20.76	20.50	0.62	0.77
Organic matter (%)	82.42	82.81	0.51	0.60
Crude protein (%)	11.81	11.12	0.30	0.13
Crude fat (%)	2.71	2.66	0.38	0.93
Larvae production (g/ kg growth media)	14.64	15.64	1.12	0.44
Larvae chemical composition :				
Dry matter (%)	23.49	24.02	1.31	0.75
Crude protein (%)	54.72	55.13	2.06	0.70
Crude fat (%)	16.75	15.91	0.92	0.85
Crude fibre (%)	6.98	6.76	0.32	0.77

BW : cattle body weight
SEM : pooled standard error of mean difference. P : probability

As shown in Table 1, larvae production was comparable (P>0.05) in both treatments despite Ongole cattle were fed different level of concentrate. It was expected that larvae production would increase as the quality of growth media was increased due to different quality of feeds offered to the animals. In this experiment, however, the quality of manure produced from Ongole cattle fed increasing level of concentrate did not significantly differ. Organic matter of the faecal matter were similar between Ongole cattle fed 1%BW of concentrate compared to 2%BW concentrated fed animal. This perhaps the reason for

Nevertheless, the level of larvae produced in this experiment was comparable compared to other experiment. Hussein *et al.* (2017) reported an approximate 20 g larvae was yielded from 1 kg dairy cattle manure. With those level and fecal production of around 9.3 kg fresh manure per day, as much as 187 gram larvae could be produced from one Ongole cattle. This means, as many as 10 to 12 chickens can be raised. This also means that, farmer may obtain significant additional income.

The effect of growth media is presented in table 2. In this experiment, it was investigated whether addition of other growth media such as chicken manure and discarded fish cut, which had higher protein content than cattle manure, was able to improve larvae production. The result of this experiment demonstrated that, addition of high CP content growth media did not improve larvae production. In fact, addition of chicken manure to cattle manure significantly reduced (P<0.05) larvae production. This indicated that cattle manure alone has sufficiently attracted house fly to lay eggs and supply the required nutrients for the growth of larvae. Similar result was also reported by Hussein *et al.* (2017) who concluded that manure from cattle is an excellent oviposition substrate for attracting adult house fly to lay eggs.

Tabel 2. Effect of growth media on production and quality of house fly larvae

Variable	Larvae Growth Media			SEM	P-value
	Cattle Manure 100%	Cattle Manure 75% Chicken Manure 25%	Cattle Manure 75% Discarded Fish Cut 25%		
Larvae production (g/kg growth media)	16.27[b]	10.56[a]	18.59[b]	62.114	0.0001

SEM : pooled standard error of mean difference. P : probability
Values followed by different alphabet differred significantly (P<0.05)

The reduced larvae production when chicken manure was added to cattle manure was a surprising result. Chicken manure contained higher crude protein than cattle manure. Myers *et al.* (2008) postulated that larvae production improves with increasing CP content of the growth media. Higher quality of growth media also corresponds to higher survivability rate of M. domestica larvae. Putra *et al.* (2013) reported higher survivability of *Musca domestica* larvae in chicken manure compared to cattle manure.

Effect of Supplementation of House fly larvae on Egg Production of Native Chicken

Data on egg production as affected by larvae supplementation to native chicken was presented in Table 3. Result of our experiment showed that total feed intake of laying native chicken was not affected (P>0.05) by the level of inclusion of house fly larvae. This result confirmed other findings that conclude that house fly larvae is a good source of protein for chicken comparable to conventional protein source such as fishmeal and soybean meal. Agunbiade *et al*. (2007) reported that feed intake of broiler chicken does not differ when housefly larvae is used to replace fish meal in the diet. Similarly, Maurer *et al.* (2016) found there was no difference in the intake of layer chicken fed diet containing larvae of black soldier fly in replace of soybean as protein source.

Table 3. Effect of larvae supplementation on egg production and egg weight of native chicken

Variables	Level of Larvae in The Chicken Diet (g/100 g)					**SEM**	**P-value**
	0	5	10	15	20		
Total feed intake (g/d)	101.45	102.74	106.10	103.92	99.86	4.039	0.845
Egg production (%)	53.19ab	63.19b	51.53ab	59.44b	32.92a	6.832	0.029
Egg weight (g)	43.08	42.77	44.51	43.31	44.51	1.361	0.886
FCR (kg feed/egg)	226.29	177.45	529.84	191.31	457.82	141.33	0.260

FCR : feed convertion ratio calculated as kg DM feed/ number of egg laid during the 60 days data collection period
SEM : pooled standard error of mean difference. P : probability
Values followed by different alphabet differred significantly (P<0.05)

Egg production of native chicken in this experiment was relatively high with the highest level reaching 60% during the two-month study. This level of production was considerably higher than the average egg production at farmer level which commonly at the average of 30-48% at its peak laying period (Sartika *et al.,* 2006). In this experiment, native chicken were fed standard commercial feed for layers which support high producing layer chicken and it is not a common practice in farmer level.

Result of this experiment showed that a significant reduction ($P<0.05$) in egg production occurred when native chicken were fed 20% fresh larvae. This was apparently due to a slight insignificant reduction in the complete feed intake. This reduction is surprising since some research revealed that the application of house fly larvae has never been reported to have an adverse effect (Pretorius *et al.*, 2007). It is frequently reported that in addition to high protein content, house fly larvae also contain excellent amino acid balance. In this case, the ratio of indispensible amino acids compared to lysine which is 1:1 is considered to be ideal. In studies conducted by Pretorius (.2011), the ratio is close to the ideal ratio. Only the ratio of arginine and lysine is low, i.e. 0.67. Unfortunately, chicken in very sensitive to arginine-lysine ratio and it is perhaps the explanation for the reduction of intake and egg production in native chicken fed 20 % of housefly larvae.

CONCLUSIONS

Manure of concentrate-fed Ongole cattle can be used as growth media for house fly larvae without a need to be combined with other higher protein-source growth media with potential larvae production up to 18 gram per kg fresh manure. Larvae produced from cattle manure is prospective to replace 15% of commercial complete feed for laying native chicken.

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