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The Effect of High Quality Feed Supplement on Growth Performance Post-Weaning Calves

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ABSTRACT

This research aimed to evaluate the effect of high quality feed supplement (HQFS) in growth performance of post-weaning calves. Twenty four calves post-weaning aged 6 months old, consisting of 12 males and 12 females, randomly divided into 2 groups, each group consisting of 6 calves. Grouping male and female calves fed control feed plus HQFS, was formulated from corn grain, corn gluten meal (CGM), pollard, soybean meal (SBM), wheat flour and agromix booster (treatment diet) as first group (treatment), and the second group was fed control feed without addition of HQFS (control). This study was conducted for 6 weeks. The variables observed included feed intake (dry matter, crude protein, and TDN), weight gain, feed conversion, feed cost per gain and body size (body length, chest girth, and withers height). The treatment was in factorial 2x2 in a Completely Randomized Design (CRD). Growth performance of post weaning calves were analyzed as repeated measures with feed (treatment and control) and sex (male and female) as factors. Results showed that the CP consumption, ADG and chest girth of treatment group was higher than ($P<0.01$) than the control group (0.42 and 0.34 kg/d, 0.95 and 0.71 kg/d, and 12.41 and 8.25 cm). TDN consumption, feed conversion, and body length of the treatment group were higher ($P<0.05$) than the control group (3.08 and 2.57 kg/d, 3.64 and 4.86, and 8.12 and 5.95 cm). DM consumption, chest girth and feed cost per gain of treatment and control group were not significant (3.87 and 3.69 kg/d, 7.30 and 6.72 cm, and IDR 16,280.00 and IDR 19,167.00). There was no difference between the growth of post-weaning calves between the male and female groups. There was no interaction between feed type and sex of the post-weaning calves. The conclusion of this study was that post-weaning calves fed HQFS (20.2%) produced better growth performance than controls.

Keyword: Growth, HQFS, Post-weaning calf

Introduction

Post-weaning growth is the growth of cattle after getting weaned. Post-weaning growth is an important phase because it is the culmination of beef cattle growth. A good growth indicator on post weaning calves is the maximum bone growth due to post weaning prepared to be bull and heifer. Susanto (2008) states that after exceeding the age of 18 months, the weight gain will be smaller and then the adult body will be reached, thus, the post-weaning growth will determine the final outcome of the cattle as adults.

Weaning is one of the crucial phases since the calf will no longer takes food from milk and depends only on the feed it consumes. The post-weaning calves that get the feed with high nutrients will experience faster growth compared with the provision of feed sufficiently and neglect of calves during the post-weaning periods result in decreased growth rates (Bhatti *et al*., 2012). There are many calf deaths during post-weaning period that is the period of adaptation of calves from milk consumption to feed consumption so they need to be given feed supplement.

Feed supplement provision is expected to help the post-weaning calves in the adaptation period, improving feed management and increasing productivity (Widiawati and Winugroho, 2008). Post-weaning growth can be measured through feed consumption, weight gain, feed conversion, feed cost per gain and body size. Feed intake is the most important one of the most nutritive factor influencing the production (Krizsan *et al*., 2014). The daily body weight gain is a change in size that includes changes in body weight, carcass weight gain the form of linear dimensions and body composition, including changes in body components such as bones and organs, muscles, fat, and chemical groups, especially for water, fat, protein and ash in carcasses (Soeparno, 2009). Feed conversion is

the relationship between the amounts of feed needed to produce one unit of body weight. Feed cost per gain is obtained by calculating the feed cost, the amount of feed ingredients consumed, associated with feed prices to obtain 1 kg of weight gain. The body size of cattle illustrates the ability of cattle to grow. Body size is used for evaluating growth and is an important indicator of growth (Fourie *et al.,* 2002).

The effort to develop commercial feed supplement has been addressed to improve beef performance. Supplement material can be mineral, probiotics, vitamin, protein source plants, and herbs. Since macro and micro mineral involved in many biological process especially in post weaned calve that required higher mineral, providing higher mineral sources will be an advantage. In addition, added essential oils into the diet is believed to improve feed efficiency, intestinal health, and improve animal performance (Jayasena and Jo, 2013). Widiawati and Nugroho (2008) reported an increased in feed consumption by 71.86% and daily weight gain byof 15.52% (Widiawati and Winugroho, 2008). In the previous research, Winugroho also reported an increased in ADG by 26.43% and improved feed efficiency of 17.58% (Winugroho *et al*., 2007).

HQFS is a concentrated supplement composed of high quality raw materials. HQFS is a combination of by pass protein with high energy source materials in the form of total digestible nutrients (TDN) and mineral mix with macro and micro minerals content that meet the nutrient requirements of cattle. The other contents in HQFS are vitamins, probiotics and essential oils. HQFS is prepared to support nutrient needs at the beginning of the growth period so as to meet the nutrient requirements to maximize the growth performance. The purpose of this study is to determine the effect of HQFS provision on the post-weaning calf growth.

Materials and Methods

Materials

The research is located in the cattle shed at Department of Animal nutrition and feed science, Faculty of Animal Science, Universitas Gadjah Mada. The research was conducted from August to November 2017. Twenty four calves post-weaning aged 6 months old, consisting of 12 males and 12 females with average weight of 101±24 kg, randomly divided into 2 groups, each group consisting of 6 calves.

Diet formulation and preparation

The control concentrate feed was obtained by mixing the commercial concentrate and molasses with ratio 97:3 on DM basis. The HQFS was formulated from corn grain, corn gluten meal (CGM), pollard, soybean meal (SBM) and wheat flour that were firstly processed in the compact form of pellets. The finished pellets were then mixed with *Agromix* booster (Mineral mix Ca 26.45%, P 0.62%, K 0.22%, Mg 0.26%, Na 4.70%, S 681.7 ppm, Fe 1.44%, Zn 300.2 ppm, Cu 229.7 ppm, Se 0.541 ppm dan Co 7.7 ppm, vitamin A, D, E dan K, probioticts (*Lactobacillus acidophilus, Enterococcus faecium, Saccharomyces cerevisiae*) and essential oils processed from walnuts, olives, soybeans, lavender, eucalyptus, coconut, orange, peppermint and sesame seeds) to obtain 89.24% DM, 5.58% Ash, 20.82% CP, 3.64% EE, 8.56% CF, and 86% TDN. Mixing of feed was done manually by hands until the feed became homogeneous. The addition of HQFS for feed treatment group was done by substituting basal ration with HQFS that has been adjusted with a ration percentage of 20.2% from total ration given. HQFS was mixed until became homogeneous. The nutritional composition of research ration is presented in Table 1.

Animal trials and treatment

Twenty four post weaned calves were allocated into to a 2x2 factorial arrangement following cross over design. The first factor was gender of calves (male and female) and the second factor was treatment and control group. Within gender, calves were blocked according to weight and assigned to the dietary treatment (control = basal diet, treatment= basal diet + HQFS; n=6). This study was conducted in two stages. In the first stage, the male and female treatment groups were fed by forage and control concentrations added by HQFS (treatment), and the male and female control groups were fed by forage and control concentrates without the addition of HQFS (control), the forage given was the rice straw and king grass. Proportion of concentrate and forage is 86:14. This study was conducted in 6 weeks. The post-weaning calves that had been fed for 6 weeks were then weighed for their final weight and then were rested and given the same feed (control) for 2 weeks. This was done to eliminate the effect of HQFS provision. The second stage of treatment was conducted reversely, in which the male and female post-weaning calves that were initially given treatment feed were fed by the control feed, similarly, the post-weaning calves that were initially given control feed were fed by treatment feed. Before conducting the second stage, the post-weaning calves were weighed to determine their body weight in order to determine the amount of feed and were breed for 6 weeks. At the end of study, the calves were weighed to determine their final weight. The variables observed included feed intake (dry matter, crude protein, and TDN), weight gain, feed conversion, feed cost per gain and body size (body length, chest girth, and withers height).

Statistical analysis

Data was subjected to ANOVA following a 2x2 factorial arrangement in a completely randomized design (CRD). Growth performance of post weaning calves were analyzed as repeated measures with feed and sex as factors.

Table 1. Nutritional composition of experimental diet

Feed	DM (%)	Ash (%)	CP (%)	EE (%)	CF (%)	NFE (%)	TDN (%)
Treatment	75.62	9.90	10.92	2.83	14.04	62.31	78.28
Control	74.71	11.17	9.17	2.72	16.78	60.16	68.51

The average daily gain (ADG) and body size were analyzed with analysis of covariance (ANCOVA) with body weight and initial body size of post-weaning calves as covariates. The male and female genders were included in the research factors with two feeding levels, that are control feed and treatment HQFS. All calculations of statistical analysis was conducted by using Statistical Product and Service Solution (SPSS) version 16.0.

Result and Discussion

Feed consumption

The feed consumption of post-weaning calves is presented in Table 2. The increase of DM consumption of the treatment and control groups was not significantly different. This is because the feed given to the treatment and control groups has the same palatability and the addition of HQFS to the treatment feed group did not affect the palatability of the feed. Arora (1995) states that feed consumption is influenced by the palatability of the feed consumed. The consumption of DM, CP, and TDN (kg/d) there was no significant difference of the male and female calves. In addition, it is also due to the post-weaning calves in this study have not reached sexual maturity, and there is no interaction between feed and sex. Decruyenaere *et al.* (2009) and Farket and Gemat (2006) adds that feed intake is positively linked to the body size and feed intake is the major factor that influences both the body weight gain. DM consumption in this study was higher than the normal requirement of cattle. Bamualim and Wirdahayati (2002) explain that the DM consumption of ruminant cattle in general 2% to 3% of body weight. The CP consumption (kg/d) of post-weaning calves were higher in the treatment group (P<0,01) than in the control group (0.42 and 0.34 kg/d). This difference was caused by the addition of HQFS which has a high protein content, Hill *et al.* (2008) states that the response of different feed consumption, including CP, is due to different nutrient content of feed. TDN consumption (kg/d) of post-weaning calves was higher in treatment group (P<0.01) than in control group (3.08 and 2.57 kg/d). The difference in TDN consumption was influenced by the consumption of nutrient feed from each treatment. Maluyu dan Suhardi (2016) states that the amount of TDN consumption is influenced by the nutrient content of feed, because TDN is a digestible feed energy derived from feed nutrient.

Body length and chest girth

The increase in body length and chest girth of the post-weaning calves in treatment group were higher than in the control group (8.12 and 5.95 cm, 12.41 and 9.25 cm) (Table 3). This was due to nutrient consumption in the treatment group higher than the control group, so that the excessive nutrients were used by the cattle for having growth, besides the mineral content, especially for calcium and phosphorus contained in HQFS also supports bone growth maximally. Gunawan *et al.* (2016) state that calcium and phosphorus play a great role in the preparation of bone and livestock development. Body length and chest girth of post-weaning calves based on sex were not significantly different, this is because the consumption of nutrients were also not significantly different, as well as the ineffective hormone since the calves have not reached the sexual maturity, so that there were no hormones that affect the growth of the effect on feed consumption appeared. Pradana *et al.* (2014) state that the androgen has not worked effectively because the calves had not reached sexual maturity. A cattle reaches its sexual maturity at the age of 12 months old (Djarijah, 2012; Wejdmark, 2014). The androgen on male calves that spur body growth cause bone growth has not increased (Rizvi *et al*., 2000), so that there is no difference in body length and chest girth. This shows that sex does not affect the body length and chest girth. Body length and chest girth of post-weaning calves based on sex were not significantly different, this is because the

Table 2. Average of feed consumtion

Variabel	Feed		Sex		Significance		
	Treatment	Control	Male	Female	F	S	FxS
DM							
Consumption(kg/d)	3.87±0.40	3.69±0.46	3.67±0.52	3.89±0.31	ns	ns	ns
Consumption/BW (%)	3.45±0.78	3.19±0.77	3.34±0.76	3.30±0.81	ns	ns	ns
CP							
Consumption (kg/d)	0.42±0.49	0.34±0.48	0.37±0.06	0.39±0.06	**	ns	ns
Consumption/BW (%)	0.38±0.08	0.29±0.06	0.33±0.07	0.33±0.09	**	ns	ns
TDN							
Consumption (kg/d)	3.08±0.35	2.57±0.36	2.73±0.47	2.91±0.39	**	ns	ns
Consumption/BW (%)	2.73±0.57	2.21±0.50	2.47±0.54	2.47±0.59	*	ns	ns

F = Feed; S = Sex; F×S = interaction between feed type and sex of the post-weaning; BW = Body weight; calves; **= highly significance (P<0.01); *= significance (P<0.05); ns = non signifikance (P>0.05).

consumption of nutrients were also not significantly different. This shows that sex does not affect the body length and chest girth, and there is no interaction between feed and sex.

Withers height

The height of withers of the post-weaning calves in treatment and control groups as well as male and female groups was not significantly different and there was no interaction between feed and sex (Table 3). It was actually quite similar between the withers of the post-weaning calves in treatment and control groups but it has different weight (Table 4). This is because continuously the rate bone growth is greater than muscle and fat growth (Dharma *et al*., 2015).

The height of withers of the post-weaning calves in male and female groups was not significantly different. Wiren *et al*. (2002) states that the androgen is a reproductive hormone that causes bone growth including height of wither increased not optimally because the calves have not reached the sexual maturity, levels of androgens in male play an important role in bone metabolism, so that the hormone has not effectively affected the growth rate. Pradana *et al.* (2014) add that, chronologically, the growth rate of body tissues was initially dominated by brain development and central nervous system, followed by bone, muscle and fat. The results of this study shows that sex does not affect the height of withers, this is because the consumption of nutrients were also not significantly different, and there is no interaction between feed and sex.

Average daily gain

The average daily gain (ADG) based on the study that has been conducted can be seen in Table 4. The ADG of post-weaning calves in the treatment group was higher (P<0.01) compared with the control group (0.95 and 0.71 kg/head). This is because the nutrient consumption of the treatment group was higher than the control group, so that the excessive nutrient was used by the cattle to gain their body weight. Lestari *et al*. (2011) states that good quality of ration and sufficient in quantity will be able to increase the productivity of livestock. Thus differences in nutrient content and the amount of feed consumed will give effect to the body weight gain because the nutrient content of the feed is balanced and accordance with the needs for optimum growth. The average daily gain (ADG) of the post-weaning calves between the male and female groups was not significantly different. This is due to the insignificant difference in the consumption of nutrients by the post-weaning calves in the male and female groups. Maluyu and Suhardi (2016) adds the level of protein content influenced the feed intake and the increasing of feed intake would increase the weight gain. The result of this study was higher than the result of study conducted (Ngadiyono, 1995) with an ADG of Brahman Cross cattles with king grass and concentrate of (15:85) with the result of ADG of 0.78 kg. The result of this study was also higher than the result of study conducted by Susanto (2008) on male and female Brahman calves with king grass (BK 18.84%) and concentrate (BK 60.73%) that had ADG of 0.37 kg/d. Based on sex, the result of this study states that the ADG of male and female post-weaning calves aged was not significantly different, and there is no interaction between feed and sex.

Feed conversion

The feed conversion based on the study that has been conducted is presented in Table 3. The feed conversion of the post-weaning calves in treatment group was higher (P<0.05) the control group (3.64 and 4.86). This suggests that the administration of HQFS in the treatment group had a better feed conversion and is more efficient than the control group. Conversion of rations was a good measure for monitoring or describing the cattle growth performance, influenced by feed quality and weight gain. The lower the value, the better feed conversion. Feed conversion ratio value will be ugly if the number becomes larger. The high feed conversion was also

Table 3. Increasing in body size post-weaning calves of the treatment, control, male and female groups

Variabel	Feed		Sex		Significance		
	Treatment	Control	Male	Female	F	S	FxS
Body length (cm)	8.12±4.34	5.95±3.39	6.61±3.48	7.45±4.51	*	ns	ns
Chest girth (cm)	12.41±3.24	8.25±4.19	9.87±4.68	10.79±3.84	**	ns	ns
Wither height (cm)	7.30±3.30	6.72±3.04	7.55±3.53	6.47±2.69	ns	ns	ns

F = Feed; S = Sex; F×S = interaction between feed type and sex of the post-weaning calves; **= highly significance (P<0.01); ***= s*ignificance (P<0.05); ns = non significance (P>0.05).

Table 4. Average daily weight gain (ADG), Feed Conversion and feed cost per gain (FCPG) of post-weaning calves of the treatment, control, male and female groups

Variabel	Feed		Sex		Significance		
	Treatment	Control	Male	Female	F	S	FxS
ADG (kg/head)	0.95±0.22	0.71±0.19	0.83±0.28	0.82±0.19	**	ns	ns
Feed convertion	3.64±1.40	4.86±1.83	4.13±1.59	4.37±1.88	*	ns	ns
FCPG (IDR/head)	16.280±6.921	19.167±7.898	16.967±6.349	18.480±8.551	ns	ns	ns

F = Feed; S = Sex; F×S = interaction between feed type and sex of the post-weaning calves; **= highly significance (P<0.01); * significance (P<0.05); ns non significance (P>0.05)

probably related to nutrient intake which was concentrated on maintenance needs related to the body's normal activities (Tahuk *et al*., 2017). In addition, Boaitey *et al.* (2017) adds that feed efficient cattle consume less feed per unit measure of beef produced. The lower the feed conversion, the better the result, because the feed used will be less and will save cost. The feed conversion of the post-weaning calves in male and female groups was not significantly different, and there is no interaction between feed and sex. This is because the daily weight gain and nutrient consumption were also relatively similar. Martawidjaya *et al.* (1999) state that the feed conversion on ruminant cattle is influenced by the quality of feed, body weight gain and digestibility value so that the good feeding will support the cattle to have faster growth, besides, the feed conversion is also influenced by the availability of nutrient in rations and cattle health. The feed conversion of post-weaning calves in male and female groups of this study is were not significantly different.

The ideal feed conversion value in beef cattle is 4.5 - 7.5 (Tahuk *et al*., 2017), when compared to this result, the feed conversion of this study is in ideal category. The results of this study are also better than the opinion by Susanto (2008) suggested that the average feed conversion of post-weaning Brahman calves fed by king grass and concentrate is 6.98.

Feed cost per gain

The feed cost per gain of treatment and control groups was not significantly different (Table 4). This means that, statistically, the addition of HQFS on post-weaning calves in treatment group has not given any difference in income from feed cost. However, based on the value, the treatment group indicated that concentrate feeding with HQFS addition resulted in lower feed cost per gain than the control group. This is due to the weight gain of the post-weaning calves in treatment group was quite high and the feed consumption was not excessive. The lower the feed cost per gain, the lower the cost incurred to generate one kilogram of daily body weight gain of cattle (Suhardiani, 1997). Based on sex, the feed cost per gain between male and female groups was not significantly different, and there is no interaction between feed and sex. The male post-weaning calves have a better feed cost per gain than the females, this is due to the higher body weight gain and lower feed consumption, so that the feed cost required to generate one kilogram of daily weight gain is lower. del Campo *et al.* (2008) state that the feed cost is an important factor in determining the economic efficiency of cattle fattening business.

Conclusions

The post-weaning calves fed by high quality feed supplement have better growth (consumption of CP, TDN, ADG, feed conversion, body length and chest girth) than those that are not given high quality feed supplement. There was no difference between the growth of post-weaning calves between the male and female groups. There was no interaction between feed type and sex of the post-weaning calves.

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