

# The Effect of Clenbuterol on Growth Performance of Growing Male Pig

Wayan Sukarya Dilaga<sup>1</sup>

*Cattle Science Department, Faculty of Animal Agriculture, Diponegoro University*

*Jl. Prof. Soedarto, SH. Kampus Tembalang, Semarang, Indonesia, 50239*

<sup>1</sup>sukaryadilaga@yahoo.com

**Abstract**— This research was aimed to determine the response of growth performance of growing male pig fed various levels of clenbuterol. The experiment was conducted using 2 x 3 factorial completely randomized design 4 times repetition. The first factor is the type of pig (L = K = local pigs and imported pig, while the second factor is the level of clenbuterol ( $T_0 = 0$  mg / kg of feed;  $T_1 = 0.20$  mg / kg of feed and  $T_2 = 0.40$  mg / kg of feed). The were 24 male grower pigs consist of 12 local pigs and 12 imported pigs with initial body weight  $28.27 \text{ kg} \pm 52.5$ . Pigs kept in individual cages for 6 weeks which is 2-week adaptation period and 4 weeks for data retrieval, with the same kind of feed consist of 27.8% bran, 55.5% and 16.7% corn concentrate. Pigs are feed 2 times a day based on their growth phase. Water was provided by ad libitum method. Variables measured were body weight gain, feed intake and feed conversion. The data obtained were analysed by range test followed by orthogonal polynomials. The results shows that clenbuterol were able to increase body weight gain, decreasing feed consumption and feed conversion. Local pig show a higher feed intake and body weight gain than imported pig, but lower feed conversion than imported pig. Statistical analysis showed no real difference for all variables.

**Keywords**— clenbuterol, body weight gain, feed consumption, feed conversion

## I. INTRODUCTION

Indonesia is a developing country where population growth annually, with demands of animal protein is in line with the population growth. Consumption of animal protein in Indonesia is only 70% of the required minimum amount of nutrition 4 grams per capita per day. There has to be a serious concern in the field of animal husbandry in order to increase the sources of animal protein in the form of meat, eggs and milk to meet the demand. In order to increase the production of meat from cattle and poultry, pigs also have a pretty good future, since raising pigs has many advantages such as reproductive cycle relatively short, many piggy in one birth, rapid growth rates, levels of use the feed is quite efficient and can utilize the remaining human food [1]. The amount of production of pig meat is the third place after the cows and poultry

with the amount increased by 7.7% annually [2, 3]. However, in the intensive maintenance system, the raising of pig still has some problems especially in feed supplements.

Application of science and technology are absolutely necessary in order to produce quality meat [4]. Examples of compounds that can improve the quality and quantity of meat is  $\beta$ -adrenergic agonist, which one of its kind is clenbuterol, a chemical compounds that affect the  $\beta$ -receptors. Adipose tissue of most species consists of  $\beta$ -receptors which when activated will stimulate lipolysis [5].  $\beta$ -agonist was also effective in dividing the activity of certain agents, for example, alter or distort the available nutrients for the formation of fat toward protein accretion. Feeding cattle by  $\beta$ -agonist will stimulate the animal growth and carcass characteristics changes [6, 7]. Sheep, pigs, cattle and poultry that received this compound will produce car asses with muscle size or total carcass protein that increases and decreases the amount of carcass fat [8]. With the use of clenbuterol can be obtained from meat less fat (lean meat) which is the tendency of modern society consumption. Indonesian native pigs originating from pig-wild boar that has been tamed, for example, Nias pig, pigs in Bali, Sumba pigs, pigs Krawang etc [9]. The good quality of pigs imported from Indonesia is ever brought landrace, Yorkshire, Tamworth, Berkshire and Poland China [10]. Crosses between local pig and pork imports are common. Pigs have a growing body of cross breeding and the use of feed that is better than local pig.

The objective of this study is to determine the response of growth performance of growing male pig fed by various levels of clenbuterol supplemented in its feed. The experiment result, hopefully can varies the information about benefits and role of the driver of this growth to the development of people's livestock industry and commercial farms in our country, which is

associated with increasing the quality and quantity of meat production and consumption of animal protein people of Indonesia.

## II. MATERIAL AND METHODS

The research was conducted at the site fattening / growth in the Village Langensari Ungaran, Semarang regency. Farm animals used were pig grower periods as many as 12 local pigs and 12 imported pigs with initial body weight  $28.27 \text{ kg} \pm 52.5$ , the age of 14-15 weeks and male sex. Local pigs were obtained from Kopeng, Salatiga. While imported pigs were obtained from a commercial pig farm enterprises of the nation's descent of Landrace. Cage that used in this experiment is permanent individual cages made of cement concrete for floors and walls, roofs of tile. The floor is made in slight angle and every plot given ditch enclosure for easy urine and feces cleaning.

Concentrate feed given is a ready to use concentrated code K-52 produce by PT Central Proteinaprima Semarang. Composition of feed is consist of bran 27.8%, corn 55.5% and 16.7% concentrate with nutrition composition as water 8.61%, protein 14.96%, ash 7.62%, 5.48% fat; crude fiber 5.97%, calcium 1.62%, 1.09% phosphorus and energy metabolism of 2400 kcal / kg.

Preliminary phase of the study lasted 2 weeks to adapt the pigs in the environment where experiment conducted, as well as relieve stress caused by transportation. A week before the experiment begin, all pigs were given de-worming tablets. Application of the treatment phase lasted for 4 weeks, the feed given 2 times a day in the morning and afternoon. Feeding amount adjusted to the needs of pigs based on the phase of life. While drinking water was given in ad libitum method.

Data analysis was using factorial experimental design with a basic design pattern completely randomized. There were 2 kinds of treatment factors: i) Level (cedar) clenbuterol:  $T_0 = 0 \text{ mg / kg}$  of feed;  $T_1 = 0.20 \text{ mg / kg}$  of feed and  $T_2 = 0.40 \text{ mg / kg}$  of feed; ii) factor of the cattle: the local pigs (L) and pork imports offspring (K). Based on that CRD factorial model used is  $3 \times 2$  model with each of 4 replications. Parameters measured were the growth performance of weight gain, feed intake and feed conversion. The data collected was then carried out the analysis that followed the test range of orthogonal polynomials.

Body weight gain was calculated by subtracting the final weight with baseline body weight, divided by the distance of time (days) between the two weighing's (kg) with 0.1 kg precision. Consumption of feed (dry matter) was calculated based on the difference between the amounts of feed given to the remainder, which had previously been converted into dry ingredients. Based on dry matter feed conversion by dividing the amount of dry matter intake with body weight gain.

## III. RESULT AND DISCUSSION

### A. Added Body Weight

Providing the level of clenbuterol on the local pigs gave no significantly different effects on body weight gain (Table 1).  $T_1$  treatment had the highest average body weight gain, followed by  $T_2$  and  $T_0$  respectively 5.93; 5.37 and 5.34 kg/week. Local Pig (L) has an average body weight gain (5.66 kg/week), higher than imported pigs (5.43 kg / week). The results of statistical analysis were not significantly different is not in accordance with the opinion of [7, 11, 12, 13] which states that the administration of  $\beta$ -adrenergic agonists, especially clenbuterol and cimaterol will improve growth, feed efficiency and carcass composition of cattle. Meanwhile, among all kind of pig variety according to [14], each pig has different growth phase and growth rate.

The highest growth rate in pigs occurred in grower phase, while the initial phase of growth tends to slow. In this study used male castration of pig grower phase of the two varieties which was local pig and imported pig. The absence of significant differences of response in both pig varieties treated by clenbuterol specially on body weight gain, caused by the similarities in response to environmental influences such as nutritional factors and physical, so feeding with nutritional and physical factors which together allow the same growth rate. According to [15], differences in growth rates between the varieties and the individual animals in varieties largely due to differences in adult body size. Treatment in all varieties of pig in grower period, not significantly affecting the rate of growth since in that period we will get the same rate of growth phase and has not yet reached adult body size of cattle and it is prevail in all varieties.

Weight always increases in each week. This data is accordance with the opinion [16] which states that the growth period of grower pigs will experience an increase in body weight gain in each

period of time. Increased body weight is thought to be due to increased muscle protein deposits as a result of the inhibition of lipogenesis or decreased carcass fat deposition [17]. To support the process of lipogenesis inhibition of  $\beta$ -receptor activity is required. According to [8],  $\beta$ -adrenergic agonist such as clenbuterol has ability to activate the receptor and stimulate lipolysis effectively. The use of compounds  $\beta$  - adrenergic agonists are also able to increase lean meat production and very efficient in the use of feed for sheep. Body weight gain in pigs treated by  $T_2$  decreased, presumably due to the side effects of clenbuterol in the feed which impact the heart beat rate instead of weight gain. The heart beat rate then decline followed by a slow heartbeat into a normal rate condition. So that cattle experiencing high stress or stress that would affect the amount of feed intake and body weight gain. According to [18], when the stress or the stress the adrenal glands release adrenaline into the blood which results in increased heart rate and blood pressure, so the cattle will use the energy reserves in the form of sugar and fat to meet energy needs during stress.

The results of this study correspond well with the statement of [13], that there are times when no response is obtained at all in the growth and efficient use of feed on the sheep that were given  $\beta$ -AA. Also in accordance with that obtained by [11] in his research, which did not receive an increase in body weight gain in sheep castration, although they use higher doses of clenbuterol (100-100 ppm) and with many repetition of 20 cattle each treatment group. The absence interaction among the varieties of pig with level of clenbuterol shows that the addition of clenbuterol dose will give the same response among the varieties of pigs especially body weight gain. Based on that, the factors can be concluding to be independent.

**B. Feed Consumption**

Results showed variance between treatment level and the nation's pigs clenbuterol and interactions both treatments provide no real difference (Table 1).  $T_0$  treatment showed the highest consumption rate was followed  $T_1$  and  $T_2$  respectively 17.70; 17.31 and 16.18 kg / week. Local pig consumption is higher (17.57 kg / week) than imported pig (16.55 kg / week). Many factors influence the consumption of livestock. According [19], a livestock feed consumption is influenced by various factors, including food palatability, physical form of feed, weight, gender, environmental temperature, hormonal balance and growth phase. The absence of significant differences between the local pigs and imported pig to feed consumption presumably because both pig have the same

growth phase and have not reached adult body size, so that the response to feed intake has the same level on nutrient content and physical form of the same feed.

The addition of clenbuterol in the feed tends to decrease the amount of feed consumption. This is presumably due to the influence of  $\beta$ -receptor that is activated by clenbuterol compounds act to inhibiting the lipogenesis, with the existence of barriers lipogenesis in animal body the energy needed will be smaller. Such circumstances would reduce the amount of feed consumed by livestock. Total consumption of feed can also be decreased due to the increased heart rate which caused by the consumption of clenbuterol. The increment of heart rate above normal is a stress for the animals that eventually led to lack or loss of appetite. According to [18], increased heart rate due to the use of clenbuterol also experienced sheep and calf.

TABLE I  
AVERAGE OF BODY WEIGHT GAIN, FEED CONSUMPTION AND FEED CONVERSION

Varieties of pig (L & K)	Level of clenbuterol mg/kg feed	Body weight gain (kg/weeks)	Feed cons. (kg/weeks)	Feed conversion
(L)		5,66	17,57	3,3
(K)		5,43	16,55	3,4
	0 mg ( $T_0$ )	5,34	17,70	3,9
	0,20 mg ( $T_1$ )	5,93	17,31	3,1
	0,40 mg ( $T_2$ )	5,37	16,19	3,1
(L)	0 mg	5,86	18,85	3,6
	0,20 mg	6,32	18,73	3,2
	0,40 mg	4,82	15,14	3,2
(K)	0 mg	4,83	16,55	4,1
	0,20 mg	5,54	15,90	2,9
	0,40 mg	5,92	17,23	3,1
CV		4,70	2,62	26,45
Lin. (Cl)		NS	NS	NS
Kuad. (Cl)		NS	NS	NS
Lin. (Cl $\vee$ B)		NS	NS	NS
Kuad. (Cl $\vee$ B)		NS	NS	NS

Description: L: local pigs, K: import pig offspring, CV: coefficient of variation, Lin. (Cl): linear effects of clenbuterol, Kuad. (Cl): quadratic effects of clenbuterol, Lin. (Cl  $\vee$  B): linear effect (Cl  $\vee$  B), Kuad. (Cl  $\vee$  B): quadratic effect (Cl  $\vee$  B), NS: not significantly different at the level of the test ( $\alpha = 5\%$ )

Increased heart rate and time to return to a normal heart rate will affect the level of feed intake. The results are consistent with [12] who reported that pigs fed 0.25; 0.50 and 1 ppm cimaterol each - each amount of daily feed consumption decreased 5.0%, 7.4% ( $P < 0.05$ ) and 8.7 % ( $P < 0.05$ ). This is confirmed by the statement and Marsmann Reeds (1991) who cited Saka (1997), that the  $\beta$ -AA tended to decrease feed intake, so that the nutrient density of the recipient animal feed should be increased, added also that the gross energy efficiency of growth was also lower in animals that received treatment  $\beta$ -AA.

**C. Feed Conversion**

The test results of variance with orthogonal polynomials shows the level of clenbuterol treatments and the nation's swine as well as the interaction of both treatments showed no real difference on feed conversion (Table 1). Feed conversion

between the treatment of local pig and imported pig from the same approach in quantitative research and its variations are very small. Local feed conversion in pigs 3.3 and 3.2 in imported pig. This shows that the imported pig is more able to utilize the feed efficiently than the local pigs. Feed consumption data show that local pig average number of feed consumption is higher than the imported pig and the data was followed with the increment of average body weight. However, comparison of body weight gain to feed intake in imported pig shows a better value. This means that energy use of feed in imported pig is more efficient.

Treatment  $T_1$  showed the best feed conversion followed by treatment of  $T_2$  and  $T_0$  respectively 3.06; 3.15 and 3.87. However, the results of statistical analysis showed the above treatment were not significantly different. The addition of clenbuterol has the effect to reduce the level of feed conversion rate, which means describing a better feed utilization. This is due to slightly lower the amount of livestock feed consumption due to the effects of clenbuterol on heart rate and its action in activating  $\beta$ -receptor to inhibit lipogenesis. Inhibition of lipogenesis toward increased deposition allows a higher lean meat. According to [8], cattle that received  $\beta$ -adrenergic agonist compounds will produce carcasses with muscle size or total carcass protein increased and decreased the amount of carcass fat. An increase in muscle size causes an increase in body weight gain of cattle so this will affect the value of feed conversion.

#### IV. CONCLUSION

The research results of various levels of clenbuterol on growth performance can be concluded that clenbuterol can increase body weight gain, reducing the volume of feed consumption and lower feed conversion. Local pig show a higher feed intake and body weight gain than imported pig, but lower feed conversion than imported pig.

#### REFERENCES

- [1] Pond, W.G. and J.H. Maner. 1974. Swine Production in Temperate and Tropical Environment. W.H. Freeman and Company, San Francisco.
- [2] Soehadji, 1991. Livestock Productivity Improvement Business in Sustainable Development. Presented Seminar, Faculty of Animal Husbandry, Diponegoro University.
- [3] Soehadji, 1990. Efforts on Creating a Framework for Livestock Development Platform Era Pelita VI. Faculty of Animal Husbandry, Diponegoro University.
- [4] Buckle, K.A., R.A. Edwards, G.H. Fleet dan Wootton. 1987. Food Science. 2<sup>nd</sup> edn. Indonesia University Press, Jakarta.
- [5] Soeparno, 1994. Meat Science and Technology. 1<sup>st</sup> edn. Gadjah Mada University Press, Yogyakarta.
- [6] Dalrymple, R.H., P.K. Baker, P.E. Gingher, D.L. Ingle, J.M. Pensack, and C.A. Ricks. 1984. A Repartitioning agent to improve performance and carcass composition of broiler. Poultry Sci. 63 : 2376.
- [7] Ricks, C.A., R.H. Dalrymple, P.K. Baker and D.L. Ingle. 1984. Use of  $\beta$ -Agonist to alter fat and muscle deposition in steers. J.Anim. Sci. 59: 1247.
- [8] Sihombing, D.T.H. 1997. Pig Animal Science. 1<sup>st</sup> edn. Gadjah Mada University Press, Yogyakarta.
- [9] Judge, M.D., E.D. Aberle, J.C. Forrest, H.B. Hedrick and R.A. Merkel. 1989. Principle of Meat Science. Kendall Hunt Publishing Company, Dubuque.
- [10] Wahyu, J. & Supandi, D. 1969. Pig Farming Guidelines. Faculty of Animal Science, Bogor Agricultural University. Directorate General of Livestock Services Press, Ministry of Agriculture, Jakarta.
- [11] Baker, P.K., R.H. Dalrymple, D.L. Ingle and C.A. Ricks. 1984. Use of a  $\beta$ -Adrenergic agonist to alter muscle and fat deposition in lambs. J. Anim.Sci. 59 : 1256.
- [12] Jones, R.W., R.A. Easter, F.K. Mc Keith, R.H. Dalrymple, H.M. Maddock and P.J. Bechtel. 1985. Effects of the  $\beta$ -Adrenergic agonist cimaterol on growth and carcass characteristic of finishing swine. J.Anim.Sci. 61 : 905 – 912.
- [13] Muir, L.A. 1988. Effect of Beta Adrenergic Agonist on Growth and Carcass Characteristics of Animal. In Committee on technological options to improve the nutritional attributes of animal products. Board on Agric. NRC (ed). Designing foods. National Academy Press, Washington, D.C., USA.
- [14] Whittemore, C.T. 1980. Pig Production. The Scientific and Practical principles. First Published. Longman Handbooks in Agriculture.
- [15] Berg, R.T. and R.M. Butterfield. 1976. New Concepts of Cattle Growth. Sydney University Press., Sydney, Australia.
- [16] Parakkasi, A. 1983. Nutrition and Food Science Mon gastric livestock. Angkasa Publishers, Bandung, Indonesia.
- [17] Kim, Y.S., Y.B. Lee, W.N. Garret and R.H. Dalrymple. 1988. Effects of cimaterol on nitrogen retention and energy utilization in lambs. J. Anim. Sci. 67 : 674 – 681.
- [18] Buttery, P.J., D.B. Lindsay and H,B. Haynes. 1986. Control and Manipulation of Animal Growth. Published by Butterworths, London.
- [19] Lubis, D.A. 1963. Cattle Feed Science. 2<sup>nd</sup> edn. PT. Pembangunan, Jakarta.