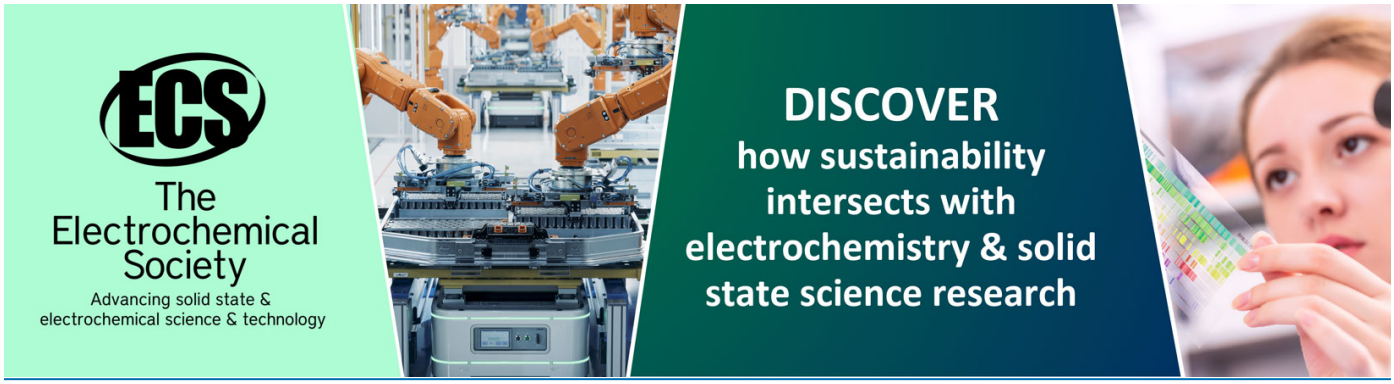
Birth Weight and Body Measurements of Purebred and Crossbred Belgian Blue Calves



IOP Conf. Series: Earth and Environmental Science **372** (2019) 012016 doi:10.1088/1755-1315/372/1/012016

Birth Weight and Body Measurements of Purebred and Crossbred Belgian Blue Calves

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Abstract. The Belgian Blue (BB) is a breed of cattle characterized by double muscling. Introduction of Belgian Blue cattle to Indonesian is to increase beef production. A preliminary study was done to compare birth weight and body measurements of purebred BB calves to F1 BB x Friesian Holstein (FH) calves. A total of 10 purebred BB calves and 20 F-1 BB x FH calves were used in this study. Results showed that birth weight and chest girth were significantly affected by genotype of calves ($P<0.05$). The purebreds had higher birth weight and chest girth ($P<0.05$). The birth weight were 54.82 kg and 42.86 kg for purebreds and crossbreds, respectively. The body height were 75.30 cm and 76.35 cm for purebreds and crossbreds, respectively. The body length were 66.96 cm and 66.33 cm for purebreds and crossbreds, respectively. The chest girth were 88.46 cm and 81.15 cm for purebreds and crossbreds, respectively. This study was a preliminary information used for recommendation in developing BB cattle.

Keywords: Belgian Blue cattle, cross-breeding, birth weight, body measurements

1. Introduction

Belgian Blue cattle, known as double muscled, are origin cattle breed from Belgium. Nowadays, Belgian Blue has developed for increasing meat production by doing crosses with local cattle breed in many countries. Introduction of Belgian Blue to Indonesia was done through importing frozen semen and frozen embryos to improve beef cattle production.

Crossbreeding was applied to increase production of local cattle. Several studies in the past have focused on crossing beef and dairy cattle, and the differences between dairy and beef purebred cattle and beef crossbreds in both performance and economic traits are widening with time [1][2] due to divergent genetic improvements to these different groups of cattle breeds.

The Belgian Blue cattle were used in many crossbreeding programs for beef improvements by combining its superiority and well adaptation of local cattle. Agung et al. [2][3] found that the myostatin gene in the Belgian Blue F1 generation individual. Therefore, any Belgian Blue crossbreds were expected to perform double muscled as the purebreds. Crossbreeding with the Belgian Blue should also improve meat yield, meat tenderness, and feed efficiency [4].

Body measurements are one of the crucial means for describing the cattle breeds. Linear body measurements were related to production and reproduction performance in cattle [5]. Some studies showed there was considerable variation influenced by breed, age, sex, nutritional condition and environmental factors on body measurements [1],[5].

It is known that the birth weight and body size of the calf significantly contributed to the ease of calving. This calf size provided the obstetrician an accurate information in predicting of the probability of natural calving [6]. There are no significant association between birth weight and heart girth of calf and dystocia [7].

The aim of this study was to compare birth weight and body measurements of purebred Belgian Blue (BB) calves with F1 BB x Friesian Holstein (FH) calves. This study was a preliminary information used for recommendation in developing BB to improve productivity of beef cattle.

2. Methodology

This study was carried out at the Dairy Goat Unit of Indonesian Institute for Animal Production (IRIAP) and Livestock Embryo Center (LEC), in Bogor. IRIAP was located on 250-350 m above sea level and LCE on 700-1200 m above sea level.

A total of 10 BB purebred calves and 20 F-1 BB x FH crossbred calves were used in this study. All BB purebreds were obtained from Embryo Transfer program. The F1 BB x FH was born from AI program using BB frozen-semen and FH cows.

During pregnancy, all dams of purebred and crossbred calves were reared in the different management system and feeding system between IRIAP and LEC. In general, they were everyday fed forages containing of King grass, legumes (*Caliandra, Leucaena, Gliricidae*) and concentrate (18% of Crude Protein and 65% TDN), 30-40 kg/day/head. Clean water were available *ad libitum*.

The traits evaluated were birth weight, body height, body length, and chest girth. After calves born, they were weighted and measured. All measurements were applied while animals were standing in normal pose were carried out using tailor tape.

The data generated were subjected to analysis of variance using the General Linear Model (GLM) of SAS [8]. Location, genotype, and sex of calves were included in the model as source of variation. Effects were considered significant at 0.05 level using P-DIFF test.

The model employed for analyses of traits measured was:

$$Y_{ijkl} = \mu + L_i + G_j + S_k + e_{ijkl}.$$

where:

Y_{ijkl} = the observed *l* (birth weight and body measurements: body height. chest girth and body length) in the *i*th Location. *j*th genotype and *k*th sex.

μ =Overall mean.

L*i* = the effect of *jth* Location (*j*=1(IRIAP) and 2(LCE))

G*j* = the effect of *i*th Genotype group (*i:*1(BB purebred) and 2(F1 BB x FH crossbred)).

S*k* = the effect of *kth* Sex of calves (*j*=1(male) and 2(female))

e_{ijkl} = random residual error.

3. Result and Discussion

The descriptive statistics for the traits evaluated are shown in **Table 1.** Mean birth weight, body weight, chest girth, and body length were 46.28 kg, 76.19 cm, 81.84 cm, and 66.50 cm. The overall means of birth weight, body measurements were in agreement of some literature studied newborn calves from FH dams and their crossbreds [9]. The body measurements of newborn calves in this study were in ranged of [10]. This study resulted in small variation (5.98-7.40%) for body measurements and moderate variation (12.89%) for birth weight.

Birth weight of calves regarded as one of the most important contributory factors for survival and for improving growth performances [7]. Comparison of the least square means for birth weight and body measurements of different genotype showed higher for purebred than crossbred calves.

Table 1. Descriptive statistics for the body weight and body measurements analyzed

Traits	N	Minimum	Maximum	Mean	Standard deviation	Coefficient variation, %
Birth weight, kg	30	30.6	67.5	46.28	5.96	12.89
Body height, cm	26	65	84	76.19	4.55	5.98
Chest girth, cm	26	68	92	81.84	5.33	6.52
Body length, cm	26	60	80	66.50	4.92	7.40

Results, in **Table 2**, showed that birth weight and chest girth were significantly affected by genotype of calves ($P<0.05$). Location influenced the chest girth ($P<0.05$). However, all traits measured were not different between male and female calves ($P>0.05$). The purebreds had higher birth weight and chest girth ($P<0.05$). Genetic affecting body weights and body measurements of cattle between purebred and crossbreeding [9]. Other study stated that birth weight of purebreds were higher than crossbreds found in Criolle purebreed and Romosinuano straightbreds compared to crossbreds with Angus or Brahman [11].

Table 2. P-value of sources of variation from traits analyzed

Traits	Location	Genotype	Sex
Birth weight, kg	0.3420	<.0001	0.2161
Body height, cm	0.2830	0.9649	0.7184
Chest girth, cm	0.0196	0.0042	0.2549
Body length, cm	0.9569	0.9776	0.2935

Table 3 presented the means (± s.e) of birth weight (kg) and body measurements of BB purebred calves and crossbreds of BB x FH. The birth weight of BB purebreds (55.27 kg) was heavier ($P<0.05$) than F1 BB x FH crossbreds (42.20 kg). Moreover, the chest girth of BB purebreds (88.73 cm) was bigger ($P<0.05$) than crossbreds (81.10 cm). The body height of BB purebreds (75.89 cm) were closed to the crossbreds (75.80 cm). The body length of BB purebred calves (66.75 cm) was similar to the crossbreds (66.66 cm).

The chest girth of calves raised in IRIAP (87.82 cm) was smaller ($P<0.05$) than LEC (82.00 cm). However, other body measurements such as birth weight (47.53 vs 49.94 kg), body height (76.93 vs 74.76 cm) and body length (66.75 vs 66.74 cm) between BB purebreds and crossbreds were not different. This body measurement indicated there was similar environment between IRIAP and LCE. Both LCE and IRIAP were located in middle land (400-700 m above sea level). Dam management during pregnancy between IRIAP and LCE were raised similar. All dams were managed in optimal condition and feeding system.

The birth weight of Belgian Blue was 43.9 kg and 40.8 kg for male and female cattle, respectively, reported by [2]. Birth weight BB ranged 45.4-51.5 kg [10]. Newborn calves of BB were BW 47.60-51.58 kg[3]. The birth weight of BB calf ranged between 35 and 65 kg, with average of 49.2 kg [6]. Birth weight was affected by weight of dams. ranged from 43 kg and 48 kg [10].

Table 3. Least square means (± standard error) of birth weight (kg) and body measurements

Variable	N	Birth weight (kg)	Body height (cm)	Chest girth (cm)	Body length (cm)
Location :					
IRIAP	22	47.53±1.37	76.93±1.23	87.82±1.91[a]	66.75±1.76
LEC	8	49.94±2.13	74.76±1.63	82.00±1.44[b]	66.64±1.33
Genotype:					
BB purebred	10	55.27±1.95[a]	75.89±1.73	88.73±2.02[a]	66.75±1.76
F1 BB x FH	20	42.20±1.47[b]	75.80±1.14	81.10±1.34[b]	66.66±1.24
Sex:					
Male	18	50.16±1.60	75.51±1.32	86.16±1.55	67.75±1.57
Female	12	47.32±1.80	76.17±1.46	83.67±1.71	65.64±1.43

[abc]within the same column. values with different letters are significantly different at P<0.05)

The birth weight of FH calves was estimated between 40-45 kg influenced by sex of calves, age, and parity of dams [12]. They found male calves were estimated to be 3.51 kg heavier than the female calves. The present study had higher birth weight than those studies. Other study found the birth weight of calves derived from Belgian Blue grandsires with 1 copy of the inactive myostatin allele was 42.2 kg [3]. This is similar to the birth weight reported in the present study.

The birth weight of male calf (50.16 kg) was not different from female (47.32 kg). There are no significantly different in birth weight of BB males (49.4 kg) and females (49.0 kg) [6]. The birth weight of BB males (51.6 kg) was closed to those of females (49.4 kg) [7]. Whereas this present study showed that body size of male and females body height (75.51 vs 76.17 cm). chest girth (86.16 vs 83.67 cm) and body length (67.75 vs 65.64 cm) were not different. However, Fiem and DeBrabander [10] reported significantly different between male (54.9 kg) and female calves (48.4 kg) of BB. Morphological characterization is one of the crucial means for describing the cattle breeds. Body measurements are important tools for phenotypic description. The main measurements were heart girth, wither height, and body length.

Newborn calves of BB were body height (cm) 71.17-72.15 cm; Heart girth (cm) 85.59-86.90 [13]. Results showed body height (75.89 cm) and chest girth (88.73 cm) of BB were smaller than Casas et al. [13]. Body measurements of BB purebreds in this study were higher than those of Kolkman et al. [6] reported that body length of BB purebred of newborn calf ranged between 44.3 and 67.8 cm with average of 56.4 cm. Hearth girth ranged between 57 and 94.3 cm, with average of 78 cm [6]. Moreover, the wither height of BB newborn calf ranged of 58.7-81.8 cm with mean of 71 cm [1]. The results found by Kolkman et al. [6] was lower than this present study. The results of present study were in agreement to some studies in Frisian Holstein and Belgian Blue calves [7,10]. However, the small differences among body measurements was due to different environment and the dam of calves.

In a study of Kama et al. [12], the heart girth, wither height, and body length of FH newborn calves were 81.9 cm, 76.2 cm, 70.9 cm. The crossbreds of BB of this present study had similar body size to Kamal et al. [12]. Crossbreeding is a way of realizing quicker genetic improvement and benefiting from complementarity combining different characteristics of genetically different animals in the crossbred [13]. This program was applied to increase production performance of indigenous and local cattle [1]. The crossbred offspring have the tendency to be superior in some quantitative traits referred

to as hybrid vigor [4]. However, the BB x FH crossbreds in this present study perform lower birth weight and body measurements than BB purebreds.

4. Conclusion

Birth weight and chest girth were significantly affected by genotype of calves. The BB purebreds had higher birth weight and chest girth. Further study are recommended using larger sample size of animals for higher accuracy.

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