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# Effect of Some Non-Genetic Factors on Birth Weight and Pre-Weaning Growth Pattern in Kedah-Kelantan Calves

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## Abstract

Birth weight records of 738 Kedah Kelantan (KK) calves and 30 records on their 3 and 6 months body weight were obtained from Pusat Ternakan Haiwan Pantai Timur (PTHPT), Tanah Merah, Kelantan during the period of 2010-2012. Data for this study were collected to identify non-genetic factors that affect birth weight and to observe growth performance of KK calves. The non-genetic factors that encompassed in this study were sex of calves, year of birth, season of birth and parity of dam. Growth performance was divided into two periods which were ADG 1 (Average Daily Gain) (birth to 3 month) and ADG 2 (3 to 6 month).The study revealed that effect of sex of calves and year of birth were highly significant ($p<0.01$) on birth weight of KK calves. Birth weight of male and female calves averaged at $14.27\pm0.055$ kg and $13.50\pm0.058$ kg respectively. Effect of season of birth and parity of dam were insignificant ($p>0.05$) on birth weight of KK calves. Growth performance of KK calves was found to be $338.148\pm15.565$ g/day and $247.407\pm45.254$ g/day for ADG 1 (birth to 3 month) and ADG 2 (3 to 6 month) respectively. Little but significant improvement in birth weight of calves over the years might be partly due to genetic selection of breeding bulls.

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## 1. Introduction

Kedah-Kelantan (KK) is a small framed well adapted but slow growing indigenous tropical beef cattle breed in Malaysia. KK cattle population comprised of 593,299 heads that constituted 85% of total beef cattle population in peninsular Malaysia (Johari and Jasmi, 2009). However, nowadays farmers intend to cross the cattle with exotic breeds to gain higher growth rate and larger body size. It is imperative to undertake conservation programme of KK cattle instead of crossbreeding. Otherwise this valuable genetic resource may be lost forever. Breed improvement initiative is considered to be complementary for any sustainable livestock conservation programme. Birth weight of beef calves is considered to be the most important single determinant of their subsequent growth. Heavier calves can grow faster and healthier compared to lighter calves. Fast growth accelerates reproductive maturity and milk production sooner (Thiruvenkadan

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*et al*. 2009). Birth weight of calves is affected by number of factors including both from genetic and non-genetic origin. Growth of cattle is manipulated by inheritance, maternal environment during nursing and other environmental factors (Albuquerque and Meyer, 2010). Study on birth weight of calves and factors that contribute on it need to be thoroughly investigated in order to have desirable growth and production in KK cattle.

There is a large gap between production and consumption of beef in Malaysia (DVS, 2012). However, beef industry in Malaysia took an upward shape in growth with 92.35% during the period from 2004 to 2012 (DVS, 2012). East Coast Economic Region (ECER) targeted to increase the cattle population in this region by 2020 at 716,000 with an expected amount of 20,000 metric tonnes of beef. Numbers of cattle heads and beef production in 2010 were 497,500 and 13,000 metric tonnes respectively, in 2010 (ECER development council, 2013). Malaysia Agriculture Research Development and Innovation (MARDI) had attempted to improve beef production by introducing exotic beef cattle breeds to Malaysia (Johari and Jasmi, 2009). Exotic beef cattle breeds that already introduced in Malaysia are Brahman, Hereford, Aberdeen, Angus, Droughtmaster, Santa Getrudis, Bali, Shorthorn, Belgian Blue, Charolais, Limousin and Chinese Yellow cattle (Johari and Jasmi, 2009). In east coast peninsular Malaysia, artificial breeding of cattle is in active operation especially in the district of Bachok, Kelantan. Although breeding of cattle is vigorously occurring, farmers' preference is to cross the local KK cows with exotic beef cattle bulls. Study proved that crossbred between KK cattle with exotic beef cattle breeds resulted in better performance in $F_1$ generation (Johari and Jasmi, 2009). If crossbreeding of KK cattle with the exotic beef breeds continues, there is a possibility that Malaysia may lose its valuable indigenous cattle genetic resource. It is important to pursue series of studies on KK cattle to help preserve the indigenous beef cattle breed. Therefore, this current study aims to determine factors that affect birth weight and growth pattern of pre-weaning KK calves. Due to unavailability of pedigree records, the study only considered non-genetic factors that affect birth weight and subsequent growth in KK calves. Non-genetic factors in this research consist of sex of calves, year of birth, season of birth and parity of dam.

## 2. Materials and methods

### 2.1 Source of data

Data used in this study were gathered from the consolidated records kept in Pusat Ternakan Haiwan Pantai Timur (PTHPT), Tanah Merah, Kelantan on 738 calves born during 2010 to 2012. There were 30 records on calves that were used to evaluate growth performance of KK calves in two stages such as at 3 and 6 months of age.

### 2.2 Feeding management

All animals in PTHPT are reared under extensive system where all of the cattle were allowed to free grazing in a fenced paddock. Grasses grown in the pasture included *Brachiaria decumben, Brachiaria humidicola* and *Centrosema pubescens.* Concentrate feed in pellet form were given to the animals once a week in group. So it is not possible to measure feed intake on individual basis.

### 2.3 Experimental layout and statistical analysis

Four factors such as year of birth (2010-2012), season of birth (dry season: Mar-Sep; wet season: Oct-Feb), sex of calves (male/female) and parity order of dam (1-10) were considered as fixed effects on birth weight of the calves encompassed in the study. For subsequent body weight of the calves at 3 and 6 months, data were grouped according to sex variation only. No other fixed effects were recorded. Data were analysed using One-way analysis of variance (ANOVA) in SPSS version 11.5 computer software to examine whether there is any significant difference ($p<0.01$, $p<0.05$) between the level of each treatment. Mean separation was performed using Duncan' New Multiple Range Test using the same computer software when significant variation was found. The analysis of variance for fixed effect was estimated using the following fixed effect model for analysis of birth weight records:

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$Y_{ijklm}= \mu + S_i + Y_j+S_k+ P_l+ e_{ijklm}$

Where,

| | | |
|---|---|---|
| $Y_{ijklm}$ | = | Birth weight of calves |
| $\mu$ | = | General mean |
| $S_i$ | = | Effect of seasons of birth (dry, wet) |
| $Y_j$ | = | Effect of year of birth (2010, 2011, 2012) |
| $S_k$ | = | Effect of sex of calves (male, female) |
| $P_l$ | = | Effect of parity of dam (1,2,3.....10) |
| $e_{ijklm}$ | = | Random error with mean '0' and variance $\sigma^2_e$ |

$Y_{ijklm}$ represents observation of birth weight of calves.All other effects including genetic effect have been embodied in the random error ($e_{ijklm}$)

Average daily gain (ADG) of calves was expressed into ADG 1 (birth to 3 month) and ADG 2 (3 to 6 month). Body weight record of every single calf was subjected to the following calculations:

$$\frac{3\ months\ weight - birth\ weight}{90} = ADG\ 1$$

$$\frac{6\ months\ weight - 3\ months\ weight}{90} = ADG\ 2$$

Then ADG 1 and ADG 2 were analysed using ANOVA with the same procedure stated in case of birth weight. Statistical model used for this analysis was:

$Y_{ij}= \mu +S'_i+ e_{ij}$

Where,

| | | |
|---|---|---|
| $Y_{ij}$ | = | Body weight of calves (birth, 3 and 6 month of age) |
| $\mu$ | = | General mean |
| $S'_i$ | = | Effect of sex of calves |
| $e_{ij}$ | = | Random error with mean '0' and variance $\sigma^2_e$ |

## 3. Results and discussions

### 3.1 Effect of sex on birth weight of KK calves

In this study, it was found that the mean birth weight of KK male and female calves (n=374) were 14.27±0.55 kg and 13.50±0.058 kg (n=364), respectively. Effect of sex of calves on birth weight of KK calves was highly significant ($p<0.01$) with 0.77 kg mean advantage of male over female (Table 1). This finding is in good agreement with the result of Habib *et al.*(2009) who reported the mean weight of Red Chittagong calves were 15.79±0.286 kg and 13.96±0.298 kg for male and female, respectively with significant difference ($p<0.05$) between sexes. Thiruvenkadan *et al.* (2009) studied sex differences in the birth weight of Murrah buffalo calves and found that males were heavier ($p<0.05$) than female. It was a trend in most cases that, male is heavier than female at birth. Male calves have bigger frame than female calves. Larger frame contribute to heavier body weight. Effect of sex on 3 month and 6 month of age in this study showed that there were no significant ($p>0.05$) difference between male and female calves (Table 2). This might be attributed to small sample size that lacked proper randomization. It may also be true that growth of female calves is almost equal to that of male in this breed during pre-weaning stage. Similarly Gunawan and Jakaria, (2011) found that there was no significant ($p>0.05$) effect of sex on birth weight and weaning weight but had significant difference ($p<0.01$) on yearling weight in Bali cattle at Bali, Indonesia.

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### 3.2 Effect of year of birth on birth weight of KK calves

Effect of year of birth was found to be highly significant ($p<0.01$) on birth weight. The mean birth weights of calves born in 2010 (n=281), 2011 (n=307) and 2012 (n=150) were 13.31±0.054 kg, 13.9±0.056 kg and 14.95±0.089 kg, respectively (Table 1). The average birth weight of calves from year to year was found to be linearly increasing. This report was corroborated well with that of Gunawan and Jakaria (2011) who stated that there was significant ($p<0.01$) difference of year on birth, weaning weight and yearling weight on Bali cattle. Report on Murrah buffalo calves by Thiruvenkadan *et al.* (2009) showed significant ($p<0.01$) difference on birth weight among the years 1990-1994, 1995-1999 and 2000-2004. Changes of birth weight over the years might be attributed by feed availability, humidity, distribution of rainfall and variation of annual precipitation (Gunawan and Jakaria, 2011). Genotype, herd, feeding management and stocking density and some other unidentified influences might change mean birth weight over the years (Habib *et al.,* 2009). However, the upward trend in herd mean indicates a gradual improvement of the trait over time in PTHPT. One of the causes might be genetic selection of bulls used in breeding which is currently in practice in PTHPT.

### 3.3 Effect of season of birth on birth weight of KK calves

There was no significant difference ($p>0.05$) on birth weight of KK calves born in different season. Mean birth weights of calves born in wet; Oct-Feb (n=272) and dry; Mar-Sept (n=466) seasons were 13.98±0.065 kg and 13.84±0.055 kg, respectively. Although the difference was not significant, the mean weight for wet season was numerically higher than in dry season. Calves born in wet season attained insignificantly higher weight that might be due to more pasture grass availability in the farm. It is fact that *Brachiaria decumbens* grow well in wet tropics (Shelton, 2012). Waters (2013) found that higher ambient temperature of weather lead to lower rate of blood flow to the womb of the cow resulting in less amount of nutrient carried to the foetus. This result agrees with Habib *et al.* (2009) and Thiruvenkadan *et al.* (2009) based on the study of the effect of season on birth weight of Red Chittagong cattle and Murrah buffalo calves, respectively.

### 3.4 Effect of parity order on birth weight of KK calves

In this study, the effect of parity of dam had no significant difference ($p>0.05$) on birth weight of KK calves (Table 1). From Figure 1 it seems that mean birth weight of KK calves fluctuated in erratic fashion as parity number of dam ascends. However, from $8^{th}$ parity onward there was a non-significant rise in birth weight of calves until $10^{th}$ parity of the dams.This result agreed with Habib *et al.* (2009) and Gunawan and Jakaria (2011). Habib *et al.* (2009) discovered that there was no significant effect ($p>0.05$) of parity of calves on birth weight but as the parity rose up, the birth weight insignificantly increased linearly. Gunawan and Jakaria, (2011) observed that there was no significant effect ($p>0.05$) of parity on birth weight but had significant effect ($p<0.01$) on weaning weight of Bali cattle. First calving usually results in lighter birth weight in cattle than in subsequent calving. Only partial development of reproductive organ of heifers at this age explains the reason behind it. Body size, reproduction organ and physiological maturity of dam attain in cow after second or third calving (Oliveira *et al.,* 1982).

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Table 1: Effect of sex, year of birth, season of birth and parity on birth weight of KK calves

| Factors | P value | Level (n) | Birth weight (kg)($\bar{x}$±SE) |
|---|---|---|---|
| Sex | 0.000 | Male (374) | 14.27±0.055 |
| | | Female (364) | 13.50±0.058 |
| Year | 0.000 | 2010 (281) | 13.31$^{c}$±0.054 |
| | | 2011 (307) | 13.91$^{b}$±0.056 |
| | | 2012 (150) | 14.95$^{a}$±0.089 |
| Season | 0.103 | Wet (272) | 13.98±0.065 |
| | | Dry (466) | 13.84±0.055 |
| Parity order 1 | 0.629 | (118) | 13.77±0.103 |
| 2 | | (112) | 13.88±0.102 |
| 3 | | (107) | 14.07±0.114 |
| 4 | | (85) | 13.98±0.122 |
| 5 | | (98) | 13.91±0.120 |
| 6 | | (82) | 13.77±0.131 |
| 7 | | (67) | 13.85±0.140 |
| 8 | | (36) | 13.69±0.200 |
| 9 | | (22) | 14.05±0.215 |
| 10 | | (11) | 14.27±0.284 |

Note: n= number of animal. $^{a,b,c}$Means with different superscripts in the same column differ significantly ($p<0.01$)

Table 2: Effect of sex of KK calves on live weight at 3 and 6 month

| Factors | Level (n) | 3 month weight (kg)($\bar{x}$±SE) | 6 month weight (kg)($\bar{x}$±SE) |
|---|---|---|---|
| Sex | Male (20) | 44.95±1.867 | 67.55±2.283 |
| | Female (10) | 45.40±2.12 | 66.90±3.828 |
| | P value | 0.885 | 0.878 |

Note: n= number of animal.

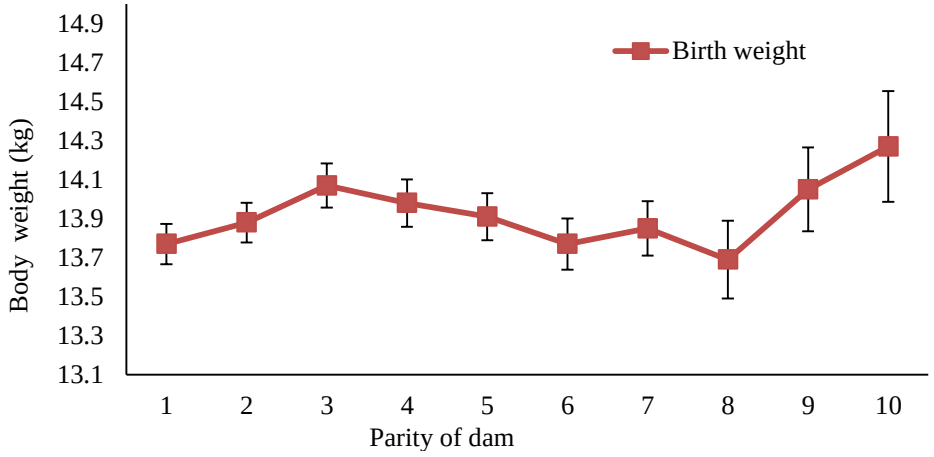


Figure 1: Birth weight of calves in order parturition

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### 3.5 Pre-weaning growth pattern of KK calves

Sex of the calves did not influence ($p>0.05$) ADG 1 and ADG 2 although it influenced ($p<0.01$) birth weight. From the findings ADG 1 and ADG 2 were 338.148±15.565 g/day and 247.407±45.254 g/day, respectively. The trend amount of ADG was declining as the animal grows. Ahmad and Basery (2003) found that ADG of KK calves from birth to 6 month, birth to 1 year and birth to 2 years were 0.24 kg/day, 0.21 kg/day and 0.18 kg/day. The findings support the trend that as the age of KK calves increase, the ADG decreases. The result are in good agreement with Gunawan and Jakaria, (2011) as there was no significant ($p>0.05$) effect of sex on weaning weight (6 month age) on Bali cattle.

Table 3: Average daily gain (ADG, g/day) from birth weight of calves up to 6 months of age ($\bar{x}$±SE)

| | Period | n | Male | Female | P value |
|---|---|---|---|---|---|
| ADG 1 (g)($\bar{x}$±SE) | Birth to 3 months | 30 | 324.444 ±21.788 | 365.555 ±14.577 | 0.219 |
| ADG 2 (g)($\bar{x}$±SE) | 3 months to 6 months | 30 | 251.666 ±23.269 | 238.889 ±39.345 | 0.769 |

## 4. Conclusion

Non-genetic factors shown to have very little or no effect on birth weight of calves except sex. Although birth weight differed between sexes but the difference did not sustain during their subsequent growth. It suggests that calves of both sexes in KK cattle may be equally good for beef finishing. For increasing birth weight and subsequent growth rate more attention should be paid to feeding and management in the calves. A little improvement was discernable from onward trend of birth weight of calves over the years, part of which may be contributed by genetic gain.

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## References

Ahmad, A. and M. Basery. (2003). Baka Lembu Pedaging di Malaysia. *In:* Penternak Lembu Pedaging. MARDI. P.1-2

Deparment of Veterinary Services (DVS), (2012). Livestock Statistics.DVS.Retrieved on June 10, 2014 from http://www.dvs.gov.my/statistik;jsessionid=85E916E86429587CA6C80C81E6491A5A

ECER development council 2013. Livestock – Meeting domestic and global demands. East Coast Economic Region, Malaysia.1-33.

Gunawan, A. and Jakaria., (2011). Genetic and Non-genetic Effect on Birth, Weaning and Yearling weight of Bali cattle. Media Peternakan, August 2011:93-98

Habib, M. A, Bhuiyan A. K. F. H. and Amin M.R. (2009). Birth Weight and Its Non-Genetic Effect in Red Chittagong Cattle in a Closed Nucleus Herd. Int'l J Biores 1(1):35-39

Johari, J. A. and JasmiY., (2009). Breeds and Breeding Program for Beef Production in Malaysia. Proceedings of the 8th Malaysia Congress on genetic presented in Genting Highland, Malaysia on 4-6 August 2009

Oliveira, J.A., DuarteF. A. M., Lobo R. B. and Bezerra L. A. F., (1982). Genetic And Phenotypic Parameters Of Birth Weight And Weaning Weight In Canchim Cattle. Brazil J. Genetics 1:131-145

Shelton, M. (2012). Brachiaria decumbens. Food and Agricultural Organisation (FAO). Retrieved on December 27, 2012, from www.fao.org/ag/AGP/AGPC/doc/Gbase/data/pf000188.htm

Thiruvenkadan, A. K., Panneerselvam S. and Rajendran R., (2009). Non-genetic and Genetic Factors Influencing Growth Performance in Murrah Buffalos. South African J of Animal Science (Supplement 1) 39:102-106

Waters, K. (2013). Factors Affecting Birth Weight. South Dakota State University. Brookings, SD 57007. Retrieved on May 25, 2013, from http://igrow.org/livestock/beef/factors-affecting-birth-weight/

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