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Growth Performance in Buffalo Calves Due to Variation in Residual Feed Intake

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ABSTRACT

Twelve buffalo calves in the age group of seven to nine month were used to study the relationship of residual feed intake with on their growth performance. During the experimental period, the animals were given green fodder and concentrates mixture as to meet their protein and energy need for growth as per ICAR, 2013 feeding standard. Daily residual feed intake was recorded for each animal and body weight was taken fortnightly. Residual feed intake (RFI) was computed for each animal and was assumed to represent the residuals from a multiple regression model. Initial mean body weight of the high RFI and low RFI groups were 127.00 and 128.5 kg, respectively. The weight recorded at last (6^{th}) fortnight was 185.17 and 186.83 kg respectively and overall mean body weight of high RFI and low RFI groups were154.79 and 155.31 kg respectively. Mean metabolic body weights of first fortnight was 38.67and 38.94 for high and low RFI groups, respectively and at the last (6th) fortnight, these values were 49.22 and 49.37 kg, respectively. Fortnightly body weights and metabolic body weights of the experimental animals showed an increasing trend throughout the experiment. The mean body weight and mean metabolic body weight (kg $W^{0.75}$) of all the experimental animals at fortnightly intervals was observed to be statistically non-significant between the groups. Overall, average daily body weight gain of high and low RFI groups during the whole experimental period was 646.30 and 648.15 g/d, respectively. The data did not show any significant difference between the groups.

Key words: *Buffalo calves, residual feed intake, growth performance, metabolic body weight*

INTRODUCTION

The concept of residual feed intake was first used by Koch *et al*.[12], who examined a number of indices for calculating efficiency which recognized that differences in both weight maintained and weight gain affect feed requirements in growing cattle. They suggested that feed intake could be adjusted for body weight and weight gain effectively partitioning feed intake into two components: (1) the feed intake expected for the given level of production; and (2) a residual portion.

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The residual portion of feed intake can be used to identify animals which deviate from their expected feed intake, with efficient animals having lower (negative) RFI values. Residual feed intake (RFI) is the difference between the actual and expected feed intake of an animal based on its body weight and growth rate over a specific period[4]. This index describes the divergence in intake from that needed for maintenance and growth and is moderately heritable[6]. The independence of RFI from production has led some authors to suggest that RFI may represent inherent variation in basic metabolic processes which determine efficiency[5,13].

There is need to improve understanding of the genetic and phenotypic relationship between feed intake and growth performance of animal so to effectively utilize RFI to optimally improve whole production system efficiency. The RFI may become useful as a means for early indirect selection in large herds. This can lead to better understanding of the possible physiological variation in the efficiency of diet use among individuals.

MATERIALS AND METHODS

An experiment of 90 days was conducted to study the relationship of residual feed intake with growth performance of twelve buffalo calves in the age group of seven to nine month. The experimental animals were kept individually under loose housing system. All standard managemental practices and biosecurity measures were followed throughout the experiment. During the experimental period, the animals were given green fodder and concentrates mixture as to meet their protein and energy need for growth as per ICAR[10], feeding standard. Daily residual feed intake was recorded for each animal and body weight was taken fortnightly. Average dry matter intake (DMI) for the 90 days feeding period was regressed on mid-test metabolic body weight average daily gain (ADG)[1,11]. Residual feed intake (RFI) was computed for each animal and was assumed to represent the residuals from a multiple regression model regressing DMI on ADG and mid-test metabolic body weight. The actual DMI minus the predicted DMI corresponds to the RFI. A more efficient animal has a negative RFI (observed feed intake is less than predicted feed intake), and a less efficient animal has a positive RFI (observed feed intake is greater than predicted feed intake). Experimental animals were weighed (kg) just before starting the actual experiment and thereafter at fortnightly intervals. The weights were recorded in the morning before providing feed and water to the animals. Using the data of fortnightly body weights average daily gain (ADG) was calculated.

STATISTICAL ANALYSIS

The results obtained during this study were analyzed by using software package SPSS.

RESULTS AND DISCUSSION

Measurement of residual feed intake

Twelve growing buffalo calves (7-9 month age) were selected for the feeding trial. After completion of three months feeding trial, RFI value for individual animals was calculated using the formula[1].

$$DMI = \beta 0 + \beta 1\ BW^{0.75} + \beta 2\ ADG + \varepsilon$$

Where β0 is the intercept, β1 and β2 are the coefficients of the equation, and ε is the residual (i.e., RFI). After that, animals were divided into low and high RFI groups. Where β0 is the intercept, β1 and β2 are the coefficients of the equation, and ε is the residual (i.e., RFI). It is given in figure1. After that, animals were divided into low and high RFI groups.

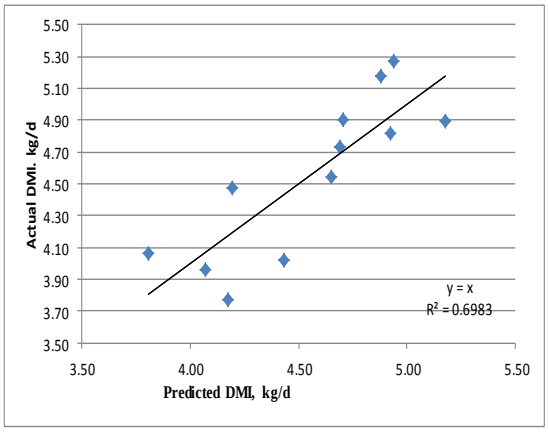

Fig. 1: Actual v/s predicted DMI of growing buffalo calves

Division of animals in high and low RFI groups

The actual DMI minus the predicted DMI corresponds to the RFI. This means that a more efficient animal has a low RFI (observed feed intake is less than predicted feed intake), and a less efficient animal has a high RFI (observed feed intake is greater than predicted feed intake). On the basis of the methodology mentioned in the materials and methods, twelve growing buffalo calves were divided into two group's i.e. low and high RFI (Table 1)

Low RFI animals

The dots below line indicates (Figure1) the low RFI animals means dry matter (DM) consumption of the animals less than their actual requirement[10] and 6 animals were considered as low RFI animals.

High RFI animals

The dots above the line indicates (Figure1) high RFI animal's means animals consumed more DM than their actual requirement[10] and 6 animals were considered as high RFI animals.

Table 1: List of animals in high and low RFI groups

Animal No.	+ RFI value	Animal No.	- RFI value
1	0.26	1	-0.11
2	0.3	2	-0.28
3	0.2	3	-0.41
4	0.04	4	-0.1
5	0.33	5	-0.11
6	0.28	6	-0.4
Overall mean± SE	0.235±0.04	Overall mean± SE	-0.235±0.06

Fortnightly body weight (kg) and metabolic body weight (kg$W^{0.75}$) of animals in high and low RFI groups

Fortnightly body weight of the animals has been presented in Table 2 and depicted in figure 2. Initial mean body weight of the high RFI and low RFI groups were 127.00 and 128.5 kg, respectively. The weight recorded at last (6th) fortnight was 185.17 and 186.83 kg respectively and overall mean body weight of high RFI and low RFI groups were154.79 and 155.31 kg respectively. Fortnightly metabolic body weights have been presented in Table 2 and depicted in figure 3. Mean metabolic body weights of first fortnight was 38.67and 38.94 for high and low RFI groups, respectively. In the last (6th) fortnight, these values were 49.22 and 49.37 kg, respectively.

Fortnightly body weights and metabolic body weights of the experimental animals showed an increasing trend throughout the experiment. The mean body weight and mean metabolic body weight (kg $W^{0.75}$) of all the experimental animals at fortnightly intervals was observed to be statistically non-significant between the groups. Arthur *et al*.[2] also reported that live weight was not phenotypically related with post-weaning RFI measurement. RFI is genetically independent of growth and size of growing cattle[3] and heifers[14] or presents low genetic correlation to BW[8].

Table 2: Fortnightly body weights (kg) and metabolic body weight ($kgW^{0.75}$) of animals in high and low RFI groups (Mean± S.E.)

Body weight (Kg)				
Fortnight	**HIGH RFI**	**LOW RFI**	**SEM**	**P- VALUE**
Initial	127 ± 7.51	128.5 ± 6.74	7.14	0.885
1st	135.17 ± 7.67	136 ± 7.28	7.48	0.939
2nd	143.33 ± 8.30	143.33 ± 6.99	7.67	1.000
3rd	152.67 ± 8.30	153 ± 8.39	8.34	0.978
4th	164 ± 9.25	163.5 ± 8.64	8.95	0.969
5th	176.17 ± 9.07	176 ± 8.23	8.66	0.989
6th	185.17 ± 8.01	186.83 ± 10.32	9.24	0.901
Overall mean± SEM	154.79±8.25	155.31±8.13	8.13	0.965
Metabolic body weight ($kgW^{0.75}$)				
1st	38.67 ± 1.70	38.94 ± 1.54	1.67	0.908
2nd	40.47 ± 1.75	40.57 ± 1.55	1.65	0.965
3rd	42.36± 1.79	42.41 ± 1.64	1.72	0.985
4th	44.56± 1.87	44.55 ± 1.79	1.83	0.997
5th	47.03 ± 1.92	46.97 ± 1.74	1.84	0.983
6th	49.22± 1.75	49.37 ± 1.89	1.82	0.956
Overall mean± SEM	43.73±1.79	43.80±1.68	1.74	0.974

Fortnight ADG (g/d) of animals in high and low RFI groups.

Fortnight average daily weight gain (g/day) in high and low RFI groups has been presented in Table 3. Overall, average daily body weight gain of high and low RFI groups during the whole experimental period was 646.30 and 648.15 g/d, respectively. The data did not show any significant difference between the groups. Our results are in agreement with the findings of Kelly *et al*.[11] and Hegarty *et al*.[7] who reported non-significant difference in ADG between low and high RFI steers. Homm *et al*.[9] also reported that ADG and body weight during the test period were not correlated to RFI in crossbred steers. Basarab *et al*.[4] reported that the relationship between RFI and ADG was 0.00 indicating that RFI may be an indicator of the animal's maintenance requirements rather than growth, size and/or appetite. Arthur *et al*.[2] concluded that RFI intake was genetically and phenotypically correlated with feed intake and FCR but not with ADG.

Table 3: Fortnight ADG (g/d) of animals in high and low RFI groups (Mean± S.E.)

ADG (g/d)				
FORTNIGHT	**HIGH RFI**	**LOW RFI**	**SEM**	**P-VALUE**
1st	544.44 ± 46.87	500.00 ± 76.49	63.44	0.631
2nd	544.44 ± 130.43	488.88 ± 40.97	96.66	0.693
3rd	622.22 ± 96.86	644.44 ± 138.42	119.46	0.898
4th	755.55 ± 74.36	700.00 ± 95.45	85.56	0.656
5th	811.11 ± 55.55	833.33 ± 102.92	82.70	0.853
6th	600.00± 118.00	722.22 ± 167.25	45.64	0.564
Overall mean± SEM	646.30±17.31	648.15±40.21	40.21	0.975

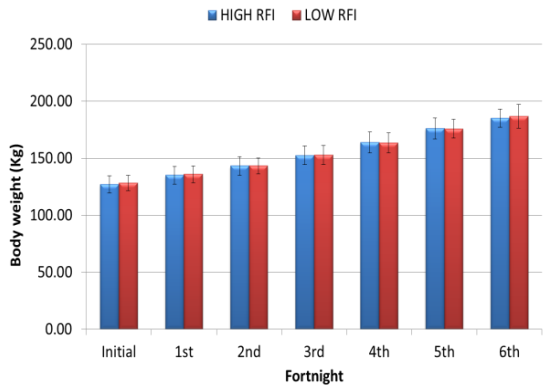

Fig. 2: Fortnightly body weights (kg) of animals in high and low RFI groups

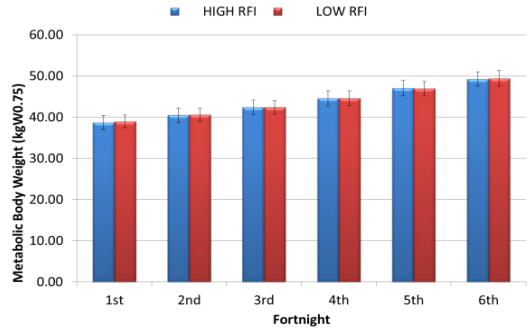

Fig. 3: Fortnight metabolic body weights ($kgW^{0.75}$) of animals in high and low RFI groups

CONCLUSION

From the result obtained in the present study it can be concluded that RFI is genetically and phenotypically independent of live weight, growth and average daily gain of growing buffalo calves.

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