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# Multiple Linear Regression Analysis for Factors Influencing Net Return Per Animal in Male Buffalo Calves Farming

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## ABSTRACT

**Background:** An integrated crop with male buffalo calves farming system consists of a range of resource-saving practices that aim to achieve high acceptable profits and sustained production levels, while minimizing the negative effects of farming. The farmers earn good income by rearing these calves up to a suitable age and then sell them to meat industry, utilize the dung and urine as manure and fodder wastages used as feeding for male buffalo calves.

**Methods:** Coimbatore, Theni and Kanyakumari districts of Tamil Nadu State were purposively selected for the present study. From each of the selected districts, 20 male buffalo calves rearer were selected randomly, covering a total of 60 male buffalo calves farmers. The collected data were analyzed, by using multiple linear regression function and study the relationship between net return per animal.

**Result:** The five variables *viz.,* sale price of animal, total variable cost, herd size, deworming practices and purchase age of animals were found to be significantly associated with net return per animal in male buffalo calves farming. The coefficient of this variable shows that for every one per cent increase in herd size, there will be 88.611 per cent increase in net return.

**Key words:** Linear regression, Male buffalo calves, Net return.

## INTRODUCTION

Livestock sector forms an important livelihood activity of the farmers, supporting nutrition of the household, supplementing incomes, offering employment opportunities (Patil *et al*. 2019). In India, male buffalo calves are considered as load and gone as such as stray animals. The meat from such animals if reared properly has great export potential. (Jairath *et al*. 2017). In buffalo production system, male buffalo calves are removed by farmers. Further, it has been observed that in India every year about 10 millions of male buffalo calves are removed or killed from the production system by farmers due to their intentional negligence in the management practices with a view to save on mother's milk. Salvaging and rearing of male buffalo calves also provide more raw materials for the domestic leather industry and open up a new avenue for rural employment. The buffalo is now increasingly being recognized as meat animal owing to heavy demand of meat of buffalo claves (Kamboj *et al*. 2007).

The rearing of male buffalo calves for meat production is an economically viable enterprise as integration with crop and fodder in some districts of Tamil Nadu near by border State of Kerala, *viz*., Coimbatore, Theni and Kanyakumari. The farmers earn good income by rearing these calves up to a suitable age and then sell them to meat industry and utilize the dung and urine as manure *viz.*, fodder wastages used as feeding for calves. Kearala, nearby state to Tamil Nadu is providing big opportunity for male buffalo calves meat sales. Rearing of male buffalo calves provides enough organic manure and helps reducing fertilizer cost. The buffalo calves efficiently convert feed into meat.

The potentialities for development of market for buffalo meat both within the country and abroad are really immense and no other country is in more favourable position than India for establishing a prosperous buffalo meat industry. There is a considerable scope for building up an export market for buffalo meat especially to the countries in the Middle East. The results of this study, as it analyze the factors influencing the rearing of male buffalo calves will aid the researchers, planners and policy makers to design suitable policy implications. Since this study analysed the variable influenced in the farming will increase the profitability in male buffalo calves farming. With these entire sources, the present study was carried out with the general objective of analyzing the factors influencing the net return of male buffalo calves rearing for meat production in Coimbatore, Theni and Kanyakumari districts of Tamil Nadu.

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## MATERIALS AND METHODS

The main objective of this research work is to evaluate the relationship between net return per animal and independent variables of male buffalo calves rearing for meat production.

Coimbatore, Theni and Kanyakumari districts of Tamil Nadu State were purposively selected for the present study, as these districts was more in terms of male buffaloe calves rearing farms along with cultivation of fodder crops and coconut trees. The total buffalo population (2019) is 3170, 1413 and 1409 in Coimbatore, Theni and Kaniyakumari districts respectively. The male buffalo calves rearing activities are much familiar with livestock farmer those who are in near by Kerala border and the high demand for male calves by meat industries which are located in around Kerala State.

**Sampling framework**

A simple random sampling technique was adopted to select the sample villages and male buffalo calves rearing farmers in selected districts. Coimbatore, Theni and Kanyakumari districts of Tamil Nadu State were purposively selected. From each of the selected districts, one block was selected and five villages from each block were selected. Four male buffalo calves rearer were selected randomly from each village totally 20 farmers in one district, covering a total of 60 male buffalo calves farmers in all three district for this study.

Pollachi block in Coimbatore district is termed as 'Coconut capital of Tamil Nadu' made district a leading producer of coconut and value-added products. The average literacy of the block was 64.97 per cent. Theni block in Theni district is a hillock town situated in the Indian state of Tamil Nadu. It is known for the large-scale trading of garlic, cotton, cardamom,grapes, mango and chilli. It hosts the second largest weekly market in Tamil Nadu and the fourth largest in South India. The average literacy of the district was 69.84 per cent. Nagercoil block from Kanyakumari district is a city and it situated close to the tip of the Indian peninsula, it lies on an undulating terrain between the Western Ghats and the Arabian Sea. 'Nagercoil Cloves' is a distinct quality of dried cloves in the spices market, noted for its aroma and medicinal value. The literacy rate of the city was 96.99 per cent.

**Period of study**

From the male buffalo calves rearing farmers so selected, relevant data pertaining to the period of two years (2018-19 and 2019-20) were collected to achieve the objectives of the study. The data were collected during the months of August 2019 and March 2020.

**Method of enquiry and data collection**

From the selected farmers, relevant data were collected so as to achieve the objectives of this study. For this purpose, structured and pretested interview schedules were used. The data were collected by personal interview method. The data were collected regarding the education level of the farmers, experience in male buffalo calves rearing especially for meat prodction, average sale price while marketing of male calves, total variable cost in male buffalo calves farming, herd size, quantity of concentrate feed consumed while rearing, deworming practices, vaccination and wallowing practices and purchase age of calves.

**Multiple linear regression analysis**

The collected data were analyzed, by using multiple linear regression function of the following form was fitted to study the relationship between net return per animal and independent variables (Table 1).

$$Y_j = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \mu$$

Where,

$Y_j$ = Net return per animal (in rupees)
$\alpha$ = Constant term
$\beta_i$ = Regression coefficients
$X_i$ = Demographic and farm related variables
$\mu$ = Random disturbance term; ($\mu_i \sim 0$, $\sigma_i^2$)

## RESULTS AND DISCUSSION

The number of male buffalo calves farms taken under study in Coimbatore, Theni and Kanyakumari districts of Tamil Nadu (Table 2). The male buffalo calves farms were classified into three groups; small (up to 10 animals), medium (11 to 30 animals) and large (above 30 animals) farms. In all the three districts, a total of 60 farms were selected with 14 small (23.34 per cent), 35 medium (58.33 per cent) and 11 large (18.33 per cent) farms. In Coimbatore district, a total of 6 (30.00 per cent) small, 12 (60.00 per cent) medium and 2 large (10.00 per cent) farms; in Theni district, a sum of 3 small (15.00 per cent), 14 medium (70.00 per cent) and 3 large (15.00 per cent) farms; in Kanyakumari district, there were 5 (25.00 per cent), 9 (45.00 per cent) and 6 (30.00 per cent) for small, medium and large farms, respectively.

It was found that net return per farm was Rs.4,60,188.00 (large), Rs.1,08,806.60 (medium) and Rs.23,548.46 (small). Net return per animal in large farm was Rs.12,871.73, medium farm for Rs.11,832.60 and small farm for Rs.7,563.91. The result explains the fact of economies of scale where net return increases with increase in farm size which optimises the utilization of factors of production. Economics of buffalo meat production (Kamboj *et al.* 2007)

**Table 1:** Description of variables used in multiple linear regression analysis for factors influencing net return per animal in male buffalo calves farming.

| $X_i$ | Variables for male buffalo calves farming |
|---|---|
| $\alpha$ | Constant |
| $X_1$ | Education of the farmer (1-literate, 0- illiterate) |
| $X_2$ | Experience of the farmer (in years) |
| $X_3$ | Average sale price at marketing (in rupees) |
| $X_4$ | Total variable cost (in rupees) |
| $X_5$ | Herd size (in numbers) |
| $X_6$ | Quantity of concentrate feed consumed (in kilograms) |
| $X_7$ | Deworming practices followed (1-Yes, 0- No) |
| $X_8$ | Vaccination practices followed (1-Yes, 0- No) |
| $X_9$ | Purchase age of calves (1->8 months, 0-<8 months) |
| $X_{10}$ | Wallowing practices (1-Yes, 0- No) |

was compared at veal stage (200kg body weight) and at beef stage (300 kg body weight) under four feeding planes. For this 32 Nili ravi male buffalo calves of an average age group of seven months and an average body weight of 105 kg were randomly allotted to four treatments. The total cost per kg meat produced was Rupees 33.3, 24.6, 25.6 and 21.6 in T1, T2, T3 and T4, respectively at beef stage of rearing. The buffalo meat production was most profitable (net income Rs.2180 per animal) under feeding plane T4 at beef stage. Under stall feeding conditions it was more profitable to rear male buffaloes up to 300 kg body weight.

To analyze the demographic and farm related personal factors associated with net return per animal in male buffalo calves farming, multiple linear regression analysis was carried out and the results are presented (Table 3). On perusal of the table, it could be noted that the computed F-value of the function was 18.23 and it statistically significant at 1 per cent level (P<0.01), indicating that a definite statistical relationship exists between the dependent variable and the independent variables. The Durbin-Watson test value was 1.99, suggesting that there is no problem of autocorrelation in the data set. The coefficient determination (adjusted $R^2$) was 0.79 which indicates that all the explanatory variables explained 79 per cent of the variation in male buffalo calves rearing. The independent variables were education, experience, average sale price at marketing, total variable cost, herd size, quantity of concentrate feed consumed, deworming practices, vaccination and wallowing practices and purchase age of calves. Among the ten demographic and farm related variables taken as explanatory (independent) variables, five variables *viz.*, sale price of animal, total variable cost, herd size, deworming practices and purchase age of animals were found to be significantly associated with net return per animal in male buffalo calves farming and the other variables such as education, experience,

**Table 2:** Number of male buffalo calves farms taken under study area.

| Herd size | Coimbatore | Theni | Kanniyakumari | Total |
|---|---|---|---|---|
| Small | 6 | 3 | 5 | 14.00 |
| (Less than 10 animals) | (30.00)[a] | (15.00)[a] | (25.00)[a] | (23.34)[a] |
| | (42.86)[b] | (21.43)[b] | (35.71)[b] | (100.00)[b] |
| Medium | 12 | 14 | 9 | 35.00 |
| (11 – 30) | (60.00)[a] | (70.00)[a] | (45.00)[a] | (58.33)[a] |
| | (34.29)[b] | (40.00)[b] | (25.71)[b] | (100.00)[b] |
| Large | 2 | 3 | 6 | 11.00 |
| (Above 30) | (10.00)[a] | (15.00)[a] | (30.00)[a] | (18.33)[a] |
| | (18.18)[b] | (27.27)[b] | (54.55)[b] | (100.00)[b] |
| Overall | 20 | 20 | 20 | 60.00 |
| | (100.00)[a] | (100.00)[a] | (100.00)[a] | (100.00)[a] |
| | (33.33)[b] | (33.33)[b] | (33.34)[b] | (100.00)[b] |

**Table 3:** Factors influencing net return per animal (in numbers).

| $X_i$ | Variables | Unstandardized coefficients | Standard error | Probability level |
|---|---|---|---|---|
| | Constant | 11323.276 | 2959.477 | |
| $X_1$ | Education of the farmer (1-literate, 0- illiterate) | 554.826 | 469.135 | 0.243 |
| $X_2$ | Experience of the farmer (in years) | -182.102 | 160.324 | 0.262 |
| $X_3$ | Average sale price at marketing (in rupees) | 10.060 | 0.004 | 0.048* |
| $X_4$ | Total variable cost (in rupees) | -0.98 | 0.130 | 0.039* |
| $X_5$ | Herd size (in numbers) | 88.611 | 19.190 | 0.000** |
| $X_6$ | Quantity of concentrate feed consumed (in kilograms) | 1.422 | 2.600 | 0.287 |
| $X_7$ | Deworming practices followed (1-Yes, 0- No) | 192.83 | 472.138 | 0.005** |
| $X_8$ | Vaccination practices followed (1-Yes, 0- No) | 91.630 | 454.138 | 0.436 |
| $X_9$ | Purchase age of calves (1->8 months, 0-<8 months) | 74.233 | 443.083 | 0.032* |
| $X_{10}$ | Wallowing practices (1-Yes, 0- No) | -531.932 | 404.685 | 0.195 |
| | Dependant variable = Y = Net return per animal | | | |
| | N | 60 | | |
| | F value | 18.23** | | |
| | $R^2$ | 0.73 | | |
| | Adjusted $R^2$ | 0.79 | | |
| | *- P<0.05, **P<0.01 | | | |

quantity of concentrate feed consumed, vaccination and wallowing practices were statistically non-significant. The independent variables (Islam *et al.* 2017) observed that such as education and experience had non significant and farm size as significant in determinants of participation in buffalo development programme and attempted to identify the socioeconomic profile of the buffalo keeping farmers and to estimate the income from buffalo farming. Study revealed that the highest per cent of farmers were in age group 31-45 years and engaged in agriculture as primary occupation. The highest number of farmers had primary level education and had above 15 years of experience of rearing buffalo. The highest return from milk production was BDT 27,189 and the BCR was 1.31 (undiscounted). The value of concentrate feed independent variable has non significant in determinants were used in factors affecting production level in buffaloes (Hussain *et al.* 2010). Regression analysis in this study is used to test how big an effect of the usage of factors such as sale price of animal, total variable cost, herd size, deworming practices and purchase age of animals on the net return of animal (Fig 1). The histogram graph presents an even distribution pattern, which means that the distribution data is normal because the ratio value is at intervals of -3 to 3. The normal probability plots (Fig 2), which shows that the dots follow and approach the diagonal line from zero and do not extend too far from it. The probability for a residual standard or standard deviation is 0.911, which means positive. Therefore it can be concluded that the regression model meets the normal assumptions or normally distributed data.

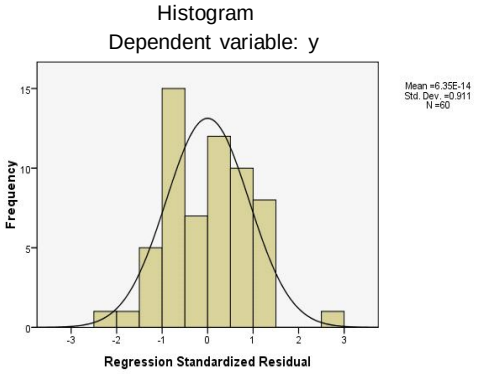


**Fig 1**: Net return per animal.

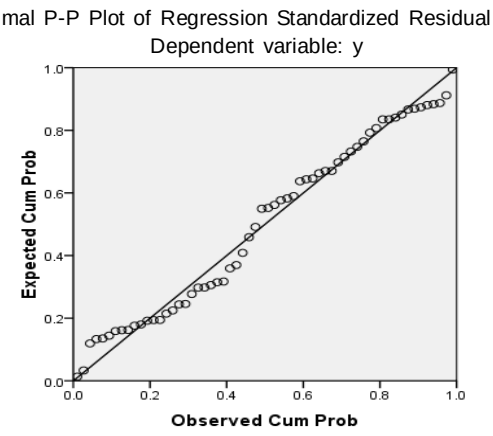


**Fig 2:** Normal probability plots test.

The variable of herd size showed positive sign with net return and was found highly significant (1 per cent level). The coefficient of this variable shows that for every one per cent increase in herd size, there will be 88.611 per cent increase in net return. This behaviour of this variable may be due to decrease in expenses attributed to increase in returns. Similarly, the estimated elasticity of coefficient for deworming practices followed reveals that by increasing number of times deworming by one per cent, the value of net return per animal increases by 192.83 per cent ($P<0.01$). This may be due to reduction in worm load leads to higher body weight gain, basically sale price fix by weight of the animal. This finding is in accordance with his study on managemental practices and mortality pattern of buffalo calves in Tamil Nadu (Balusami, 2015). The variable of total variable cost illustrated negative sign and was found significant with five per cent level. The coefficient of this variable shows that for every one per cent increase in total variable cost, there will be 0.98 per cent decrease in net return in male buffalo calves rearing. Similarly, the estimated elasticity coefficient for purchase age of calves shows that increasing purchase age by one per cent the value of net return increase 74.22 per cent ($P<0.05$). This indicates that the higher age group animal having higher weight and also reduction in rearing period also. The variable sale price of animal is significant at 5 per cent level. In the every one per cent increase in selling price leads to 10.06 per cent increase in net return of male buffalo calves rearing. This is the common factor, when increase in selling price leads to increase in net return in farm.

## CONCLUSION

Results of the present study revealed that the sale price of animal, total variable cost, herd size, deworming practices and purchase age of animals were found to be significantly associated with net return per animal in male buffalo calves farming. Advice the farmer to fix the sale price based on the weight of the calves, follow the deworming once in three months and purchase above 8 months age calves for better weight gain and more profit. Further suggested that the increase the flock size and reduce the variable input expenses leads to increase the net return in male buffalo calves rearing.

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