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Comparative Studies Between Some Regression Methods to Predict Carcass Cuts in Soviet Chinchilla Bucks Reared in Eastern India

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Abstract: The study pertains to estimation of carcass cuts in Soviet Chinchilla bucks. The results indicate that the slaughter weight significantly influences the weight of the fore legs ($P< 0.05$) and hind legs ($P< 0.01$). The quadratic regression equations provide the best estimators for all the carcass cuts and the carcass as a whole. The accuracy of the predictors is highest for

Key words: Soviet Chinchilla bucks · Regression equations · Carcass cuts · Eastern India

INTRODUCTION

Rabbit are reared both for pelt, meat and as laboratory animals. It is estimated that the total population of rabbits reared under farm conditions in India is estimated to be around 0.47987 million, the numbers of rabbits other than the wool type Angora breed is estimated at 123 thousand buck and 143 thousand does, with a population of 102 and 113 thousand bucks in the does respectively in the rural area and the remaining in the urban area respectively [1].

Rabbit rearing in West Bengal is being promoted by the authorities of the government as a mean to create employment opportunities for the less advantaged section of the society and also to create rural employment opportunities. However, it has since been noticed that many of the people who started rearing the rabbits in a commercial scale are closing down the profession. This is grossly attributed to lack of adequate marketing channel for the meat and also because the cost of feeding the rabbits is significantly higher than that of the small ruminants (because a significant part of the diet comprises of concentrate feed which is getting costlier day by day). Another factor that is leading to the disinterest is the entrepreneurs are the traditional culinary habit of the meat consumers where there is no place for the rabbit meat. Therefore, one of the ways save the potentially important industry is to go in for meat processing where important carcass cuts can be processed and sold to the customers form the high niche of the society. The usual process of growth has been many times measured on a longitudinal time frame, however keeping into account allometric growth of the different organs it has been observed that the growth of different species and may be even breeds and types are different at different phases of life and hence can be best fitted using different growth/ non linear models. The present study therefore was carried out to predict the weight of the different commercially important carcass cuts of the rabbits using non invasive techniques.

MATERIALS AND METHODS

The data under consideration pertains to 30 Soviet Chinchilla bucks that were reared at a commercial farm situated in the state of West Bengal, India. The region where the study was conducted is situated near to the tropic of cancer and is characterized by hot (20-37°C) and humid (65-97%) climate the year round (except for the two months of the year December and January when the climate is cold and humidity is also less) . The rabbits were reared in individual cages (after weaning 30 days of age) till they were slaughtered at 85 days of age. The rabbits were reared on self formulated ration comprising of maize (75%), soybean cake (5%), sunflower cake (10%), sesame cake (7%) and appropriate amount of minerals and vitamins (3%), besides green grass (fodder sorghum (*Sorgum bicolor*), para grass (*Brachiaria mutica*), doob grass (*Cynodon dactylon*) were given adlib, depending upon the season and availability. Prior to slaughter the rabbits were fasted for 8-12 hours when they received only water. Individual animal was weighed on a digital

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balance (error margin of 0.5 grams) prior to slaughter. The organs were weighed on a digital balance. The animals were slaughtered in a way to ensure complete bleeding. Following bleeding each rabbit was re weighed to obtain the amount of blood loss during the process of slaughter. After slaughtering the rabbits were de skinned and the paws and tail were cut away. The carcass was eviscerated and the weight of the carcass was taken on the same digital balance. Thereafter the carcass was cut into neck (part of the carcass from the atlas vertebrae prior to the first thoracic vertebrae), thorax (the part from the thoracic vertebrae till the last ribs, including the breast part of the carcass), the fore legs (the part of the legs including the shoulder blade till ahead of the metatarsus), hind legs (two hind legs with the part just ahead of the metatarsus), lumber (the area just behind the thorax till, just ahead of the first coccygeal vertebrae). Each of the carcass cuts from every slaughtered rabbit was weighed individually.

The data was analyzed statistically using curve fit regression equations namely linear, logarithmic, inverse, quadratic, compound, power, sigmoid, growth, exponential and logistic. The accuracy of the different regression equations were compared using the coefficient of determination values (R^2). The regressions were calculated using statistical software SPSS V12. for Windows.

RESULTS AND DISCUSSION

The weights of the different carcass cuts of Soviet Chinchilla bucks reared in hot and humid climate of eastern India are presented in Table 1. The results from the table indicate that the average dressing percentage as obtained in the study is comparable with the observations obtained by Lopez *et. al.* [2] for Gigante de España (GE) rabbits and GE X Solam crossbreds, similar results pertaining to dressing percentage was also obtained by Ozimba and Lukefahr [3] in New Zealand White (NZW) and Californian (CAL) purebreds and their crosses with Flemish Giant (FG) and Champagne D'Argent rabbits, Dorota *et. al.* [4] for NZW and CAL and their reciprocal crosses Templeton [5] and USDA [6] too indicated similar values for dressing percentage in rabbits. The average weight of the neck (WN, in percent terms), weight of the thorax (WTH, in percent terms) and weight of the lumber region (WLM, in percent terms) are also presented in the Table 1. The values of weight of the fore limbs (WFL, with respect to the percentage values of carcass) and the weight of the hind legs (WHL, with respect to the values obtained in the carcass cuts) find similarity with the observations of Oteku and Igene [7] in NZW rabbits reared under different feeding regimes at Nigeria.

Table 1: Weight of different carcass cuts from Soviet Chinchilla bucks (a with respect to live weight, b with respect to carcass weight)

WBS Mean±SE	WC Mean±SE	WN Mean±SE	WFL Mean±SE	WHL Mean±SE	WTH Mean±SE	WLM Mean±SE
2222.55±69	1285.44±75	95.88±2.7	210.5±5.8	354.55±11.	308.11±15.6	315.77±8.0
	(57.83)[a]	(4.31)[a] (7.45)[b]	(9.47)[a] (16.37)[b]	(15.95)[a] (27.58)[b]	(13.86)[a] (23.96)[b]	(14.2)[a] (24.56)[b]

Table 2: Analysis of variance studies indicating the influence of slaughter weight on some carcass parameters of Soviet Chinchilla bucks (**P<0.05, * P<0.01)

Traits	Fcal
WC	.396
WN	.445
WFL	2.583**
WHL	7.683*
WTH	.774
WLM	.294

Table 3(a): Regression equation for estimating weight of the carcass cuts of Soviet Chinchilla bucks with respect to weight before slaughter

	Weight of carcass		Weight of the neck		Weight of fore leg	
Type	R^2	Equation	R^2	Equation	R^2	Equation
Linear	.212	226.43 + .4976(x)	.453	14.567+.0262(x)	.357	75.11+.0501(x)
Log	.224	-7630+(1163.55 In(x))	.469	-395.3+(60.78ln (x))	.386	-727.41 + (118.65 In(x))
Inverse	.236	2555.7-.000003/(x)	.484	136.16-139601/(x)	.415	312.71 -278318/(x)
Quadratic	.303	-8948.4+8.6(x)-.0018 (x^2)	.541	-311.34+.313(x)-.00006(x^2)	.687	-1282.5+1.246(x)-.0003 (x^2)
Compound	.253	$528.71+1.0004^{(x)}$	.461	$32.09+1.0004^{(x)}$	.376	$99.343 +1.0003^{(x)}$
Power	.267	$.8141 (x)^{.959}$	.478	$.1042 (x)^{0.8497}$	.407	$1.0924 (x)^{.6668}$
S	.281	$e^{8.19-2224.9/(x)}$	.495	$e^{5.168-1953.1/(x)}$	.438	$e^{5.934-1564.5/(x)}$
Growth	.253	$e^{6.27+0.0004(x)}$	.461	$e^{3.4687+.0004(x)}$	.376	$e^{5.47-0.0296(x)}$
Exponential	.253	$528.71X0.0004^{(X)}$	.461	$32.0962 X.0004^{(x)}$	.376	$99.34 X .0003^{(x)}$
Logistic	.253	$1/405+e.^{-(0019+.9996(x))}$	.461	$1/670+e.^{-(0312+.9996(x)}$	.376	$1/1050+e^{-(0.0101+0.9997(x)}$

Table 3(b): Regression equation for estimating weight of the carcass cuts of Soviet Chinchilla bucks with respect to weight before slaughter

	Weight of the hind legs		Weight of thorax region		Weight of the lumbar region	
Type	R^2	Equation	R^2	Equation	R^2	Equation
Linear	.520	98.04 +.1154(x)	.432	-40.77+0.148(x)	.272	139.883+.0602(x)
Log	.555	-1736.3+(271.45 In(x))	.460	-2389.9+(347.67ln (x))	.284	-804.96 + (140.048 In(x))
Inverse	.591	641.42 -6732870/ (x)	.489	655.11-809629/(x)	.295	420.072 -322741/(x)
Quadratic	.863	-2541.9+2.4(x)-.0005 (x2)	.702	-3334.1+3.048(x)-.0006(x^2)	.349	-762.12+.8547(x)-.0002 (x2)
Compound	.517	$166.13+.0003^{(x)}$	.452	$84.33+1.0005^{(x)}$	.279	$166.42 +1.0002^{(x)}$
Power	.553	$.7516 (x)^{.7987}$	.482	$.0141 (x)^{1.2867}$	.291	$0.0060 (x)^{.9998}$
S	.590	$e^{6.7111-1864.3 / (x)}$	.513	$e^{7.01-2999 /(x)}$	.302	$e^{57.1122-..0035/(x)}$
Growth	.517	$e^{5.11+0.0003 (x)}$	.452	$e^{4.4347+.0005(x)}$	.279	$e^{5.114 - 0.0002(x)}$
Exponential	.517	$166.13X 0.0003^{(x)}$	.452	$84.32 X.0005^{(x)}$	.279	$166.42X .0002^{(x)}$
Logistic	.517	$1/405+e^{-(0.006+.9997 (x))}$	.452	$1/670+e^{-(.0119+.9995(x))}$	.279	$1/1050 +e^{-(0.006 + 0.9998 (x))}$

The results from Table 2 indicate that the WBS influences WFL ($P<0.05$) and WHL ($P<0.01$) while other carcass parameters are not influenced by the same, similar observations have been reported by Oteku and Igene [7] in NZW rabbits reared in humid regions of Nigeria. The present results are in consonance with the observations of Piles *et. al.* [8], they reported that dressed carcass weight did not significantly influence proportion of retail cuts in rabbits.

The significant results pertaining to WFL and WHL with respect to WBS might be attributed to the growth of the long bones i.e. humerus radius and ulna (forelimbs) and tibia and femur (hind limbs). Lawrie [9] opined that the growth of the limbs in animals take place till such time the puberty is reached. The non significant effect of WBS and WC can be attributed to higher weight of the giblets in rabbits of higher weight and vice versa. Hernández *et al.* [10] opined that the allometric coefficients of the giblets (liver percent, kidney percent, thoracic viscera percent) along with that of the head decreases with the growth of the animal which is later replaced by fat, the authors were in opinion that the heavy rabbits had lower organ percentage and heavy lion percentage. Brzostowska et. al [11] in Danish white rabbit and also Michalik *et. al.* [12] in French laptop rabbits opined that the contents of the carcass and the carcass cuts are non significantly correlated, the findings being in consonance with the present results.

The results pertaining to coefficient of determination (R^2) values and also estimation of weight of carcass (WC) and different carcass cuts in Soviet Chinchilla bucks are presented in Tables 3(a) and (b) respectively. The study indicates that the R^2 values were higher for quadratic regression (qua) equation followed by S (sigmoid) regression equation for WC trait; however, in both the cases the R^2 values are quite low indicating a low degree of accuracy.

The R^2 values attributing to the prediction of the weight of the neck (WN) taking into consideration the weight before slaughter (WBS) indicates that the higher values are obtained using the qua regression equation followed by the inverse (inv) regression equation. The weight of the fore legs (WFL) can be best predicted using the qua regression equation, however R^2 values for all the other regression equations studied were not even close to the values obtained in the qua regression equation. The regression values for predicting the weight of the hind leg (WHL) also indicated that the qua regression equation served as a better predictor followed by the inv and closely followed by the S regression equation. The results also indicate that the WHL is the only carcass cut that can be predicted with a fairly high degree of accuracy by using the WBS as a non invasive predictor in rabbit bucks of Soviet Chinchilla breed.

The present study further indicates that the weight of the thorax (WTH) can be predicted best using the qua regression analysis, however the results are not as accurate as that of the hind leg. The results from the prediction of lumber region (WLU) also indicates that the qua regression equation is the best predictor of all the regression equations studied, however the R^2 values are quite low, indicating poor accuracy.

The present study indicates that qua regression equation can serve as the best predictor for assessing the different carcass cuts using the slaughter weight as the predictor for Soviet Chinchilla bucks reared in hot and humid climate of Eastern India.

CONCLUSION

The study conducted on Soviet Chinchilla bucks reared at hot and humid climate of Eastern India indicates that the slaughter weight significantly influences the weight of the fore and hind limbs. The results of the

regression equations using slaughter weight as predictor indicates that the quadratic regression equations are better predictors. The coefficient of determination value was highest for weight of the hind limbs followed by that of the thorax region.

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