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Short communication

ASSESSMENT OF FARMERS' PERCEPTION ABOUT BEETAL GOATS IN PAKISTAN BY USING LOGISTIC REGRESSION

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ABSTRACT

Choice experiments with 64 choice sets of six attributes (each at two levels) of Beetal goats were performed. Randomly chosen choice sets were used in eight blocks, each with 8 choice sets. Eight choice sets of female and 8 for males were presented to each farmer and 32 farmers were surveyed. The data thus obtained in the form of "selected" or "not selected' were put to analysis using Logistic regression in binary form. Farmers showed greater inclination towards economically important traits and showed lesser concern to beauty traits & body size. It is therefore suggested that for maximizing economic benefits, the goats should be kept and bred keeping in view the farmers' preferences.

Key words: Choice experiments, Beetal goats, logistic regression, farmer preference.

INTRODUCTION

Goat is an important livestock species serving the humanity in many ways by providing red meat, milk, skins, recreation and pet services. The animal possess a number attributes for selection. Each farmer has its own choice of attributes and rear animal for specific purpose. Though, height, weight, length, milk production being quantitative are given more emphasis yet skin colour, presence/absence of horns, multiple kidding and price per head are not ignored by the farmer. There are a number of ways to investigate farmer's preferences. One of the approaches is to ask farmers to classify traits into different categories on the basis of importance moving from important to unimportant or ranking the traits according to their importance, the most important being on the top (Mwacharo and Drucker, 2005). Some researchers have described the farmer's preferences about the relative importance of traits (Scarpa *et al*., 2003; Tano *et al*., 2003). Stated preferences for Ankole cattle, for example, were studied by Wurzinger *et al*. (2006) using the choice experiments while lifestyle and herding practices were investigated by Wurzinger *et al*. (2008).

Computers revolutionized the research work. Traditionally, general linear models were extended to construct choice design, but computers made this process easy and efficient. This machine increased the design efficiency by incorporating the anticipated model parameters and reducing the number of required choices to a considerable limit. Complex choice designs can be easily generated, allowing research worker to conduct choice experiments that more closely reflect actual market situations. Model and design modifications and trade-offs between a design's statistical benefits and its operational and behavioral costs can be well considered (Kuhfeld, 2005).

Other aspects of Beetal goats' characterization have been explored (Waheed, 2011) including growth (Waheed *et al*., 2011) and, lactation curve (Waheed and Khan, 2013). Preference of farmer for certain traits of this breed was to be investigated. Hence Beetal breed was the target of this study and used as a case study. The breed is important and plays a significant role in the lives of rural people and goat keepers serving a number of purposes like meat and milk. The breed is known for its large size, typical coat colours and milk production. Mainly found in the province of Punjab, it has been taken to other provinces for rearing as meat and milk animal. It is also most preferred breed for sacrificial purpose. Twinning is also common in this breed. The objective of the study was to gain firsthand knowledge of farmers' perception about Beetal goats and their production.

MATERIALS AND METHODS

The present study was accomplished in Faisalabad and Okara districts, which are among the home tract of Beetal breed in Punjab province. The area is canal irrigated and spread along the plains of two rivers, Chenab and Ravi. Most of the population is in rural areas and livestock is integral part of the economy. Data on farmer's perception about goat were recorded using choice experiment. A total of 32 farmers in the experimental area were interviewed. Six attributes each at two levels, of male and female goats, were used to make 64 choice profiles. The female attributes were horns, coat colour, body size, litter size, daily milk yield and price of the animals. The male attributes were horns, coat colour,

temperament, body size, testes size and price. Description of attributes and their levels is given in Table 1. A set of 8 choice profiles of female and 8 choice profiles of male was presented to a farmer and the same profiles were repeatedly presented before four farmers. Each farmer has to choose one profile out of the eight, thus generating four observations on female and four on male choice profiles. A total of 32 farmers showed their preferences out of the given set of profiles containing 8 alternatives. Design Expert Version 8 (2009) was used to design the choice experiment with six factors each at two levels.

Table 1. Attributes and their levels used in choice experiments

Doe attribute	Levels	Buck attribute	Level
Presence of horns	1. Horned 2. Polled	Presence of horns	1. Horned 2. Polled
Coat colour	1. Black and white (BW) 2. Any other (NBW)	Coat colour	1. Black and white (BW) 2. Any other (NBW)
Body size	1. Large 2. Small	Body size	1. Large 2. Small
Litter size	1. Singles (1) 2. Twins (2)	Temperament	1. Docile 2. Aggressive
Milk yield	1. Nearly 1 kg (1) 2. More than 1 kg (2)	Testes size	1. Big 2. Small
Price	1. Market price (MP) 2. More than market price (MP500)	Price	1. Market price (MP) 2. More than market price (MP500)

Logistic regression is employed when the response variable is dichotomous. Here, in this study the dependent variable was "selected vs not selected", a binary variable. Therefore, logistic regression was the model of choice. In logistic regression, the dependent variable is a logit, which is the natural log of the odds and odds are a function of P, the probability. Mathematically,

$$\text{logit}(P) = \ln \frac{P}{1-P}$$

Logistic regression model in linear form was

logit (P) = a + bX + e

Where 'a" is the intercept, 'b' is regression coefficient, X is independent variable and 'e' represents the residual term.

Data obtained from survey were subjected to logistic regression analysis with the help of Statistical Package for Social Sciences Version 10 (SPSS, 1999).

RESULTS AND DISCUSSION

The respondents were all (100%) male rearing on the average 3.5 goats per head. The results for female and male goats are presented in Table 2 and 3, respectively. In both the regions traits concerned with economics (litter size, milk yield, body size) were more important than the beauty traits (horns, coat colour). The preferences for female traits showed that in both districts (Faisalabad and Okara) litter size and milk production were more important than beauty traits. The odds ratios for litter size were 12.3 and 9.4 and for milk production 4.3 and 2.3 for Faisalabad and Okara districts, respectively (Table 2).

In male goats, the odds ratios for different traits in descending order are: temperament (2.0), price (1.3), horn (0.64), coat colour (0.64) and body size (0.03) (for Faisalabad district) and temperament (1.6), coat colour (0.96), price (0.83), horn (0.61), and body size (0.04) (for Okara district) (Table 2).

Different statistics like -2 Log likelihood, Cox & Snell R^2, Nagelkerke R^2, Hosmer and Lemeshow goodness of fit test are given in Table 4. The R^2 are not the coefficient of determination as in common regression analysis. The value of -2log likelihood is not very large for both males and females, showing good-fit of the model. The likelihood ratio test (-2LogL – χ2 value) also shows the goodness of fit of choice models for both female and male goats.

Farmers opine differently for different attributes of goats but preferred attributes were mostly quantitative in nature and economically important. Some attributes showed wide range of odds ratios while others had narrow range. For instance, in Faisalabad districts litter size had the widest range, followed by milk production and presence of horns. The two economically important attributes showed more concern of farmer. Body size and price had the least ranges of odds ratios for does in Faisalabad. Similar trend was seen in Okara district. It was found that farmers were interested in prolificacy and were ready to pay higher price for this attribute. Overall values also showed similar trend of odds ratios. For female goats, aesthetic traits and body size had lower odds ratios in both the districts while traits of economic

importance showed higher odds ratios. In Faisalabad district, presence of horns had higher odds ratios than in Okara but coat colour possessed lower odds ratio in Faisalabad. Litter size and milk production also showed greater odds ratios in Faisalabad. In Okara district, price showed higher odds ratio than in Faisalabad showing a trend of purchasing goats of their choice at higher prices.

Table 2. Odds ratios and 95% confidence interval for Beetal does.

Location	Horn	Coat colour	Body size	Litter size	Milk production	Price
Faisalabad	3.2 (0.8-12.3)	1.0 (0.3-3.6)	0.0 (0.0-0.3)	12.3 (2.2-68.2)	4.3 (1.1-17.8)	0.6 (0.2-2.2)
Okara	1.4 (0.4-5.4)	1.4 (0.4-5.4)	0.1 (0.0-0.3)	9.4 (1.9-45.8)	2.3 (0.6-8.9)	1.8 (0.5-6.8)
Overall	2.1 (0.8-5.5)	1.2 (0.5-3.0)	0.0 (0.0-0.2)	10.7 (3.4-34.2)	3.1 (1.2-8.3)	1.0 (0.4-2.6)

Table 3. Odds ratios and 95% confidence interval for Beetal bucks.

Location	Horn	Coat colour	Body size	Temperament	Testes size	Price
Faisalabad	0.6 (0.2-2.3)	0.6 (0.2-2.3)	0.0 (0.0-0.3)	2.0 (0.6-7.3)	0.0 (0.0-0.3)	1.3 (0.4-4.6)
Okara	0.6 (0.2-2.3)	1.0 (0.3-3.5)	0.0 (0.0-0.4)	1.6 (0.4-6.1)	0.0 (0.0-0.3)	0.8 (0.2-3.0)
Overall	0.6 (0.2-1.5)	0.8 (0.3-1.9)	0.0 (0.0-0.1)	1.7 (0.7-4.2)	0.0 (0.0-0.1)	1.3 (0.5-3.3)

Table 4. Values of different statistics for female and male goats.

Parameter	Female	Male
-2 Log likelihood	38.97	52.81
Cox & Snell R^2	0.524	0.283
Nagelkerke R^2	0.707	0.413
Hosmer and Lemeshow test (Chi square)	16.95	18.73

In case of males, temperament had the widest range of odds ratio followed by price per head in Faisalabad district. The farmers were choosy in temperament because of ease of handling the animals. Due to their importance to serve as buck or to sale for sacrificial purpose, the males had higher odds ratios for price. Presence of horns and coat colours had similar range while size of body and testes had the least range of odds ratio. Similar ranges of odds ratio were found in Okara districts, coat colours having slightly wider range than horns. Overall ranges for odds ratios had the same trend for male attributes. Temperament, in males, was an important trait with higher odds ratio for Faisalabad district. Price was the second most important concern and goat keepers were keen to pay more for their desired character. Horn and coat colour had similar odds ratios in Faisalabad district but coat colour had greater odds ratio for Okara district showing the interest of farmers in particular colour i.e. black and white. Body size and testes size had the least and similar odds ratios in both districts. The farmers were willing to pay more for their preferences because they expected better off-spring, in terms of beauty and production, from their expensive bucks.

The present study though was quite preliminary with fewer options but threw light on some important aspects of farmer's perception about goat. The comparison of present study seems difficult as other researchers used different species and defined traits in their own way. A number of researchers studied production systems, some investigated choice of breeds by the farmers, a few researchers studied preference for production systems and others studied other traits. In a survey study by Wurzinger *et al*. (2003), it was found that reproductive and productive traits (fertility and milk yield) were more important than beauty traits (horn, coat colour) and size in cows. For bulls, important traits with higher preference were: mother's milk production, temperament and price. Jaitner *et al*. (2003) reported that growth, pedigree information and dam's performance were traits of higher preference for dairy bulls in Western Africa. Tano *et al*. (2003) reported that fitness for

traction, fertility and resistance to diseases were the preferred traits in bulls and in cows the preferred traits were reproduction, resistance to diseases and ease of feeding.

Discussion with farmers revealed the advantage of Beetal goats over the other breeds and crossbreds that they had higher growth rate when fed *ad lib* and showed better resistance to diseases. Also, they narrated that this breed is preferred for sacrificial purpose and masses show greater interest and are ready to pay higher prices for males of this breed. Farmers were keen to produce higher number of males because of higher economic benefits. There was a trend to grow and fatten the males for sale on the religious event called "Eid-ul- Azha". Therefore, a general likeness was seen for rearing this breed in the survey area.

Choice experiment provided an effective way of examining the preference of farmers for different attributes of goats. It was evident form the present study that economically beneficial and cost effective attributes were preferred. Hence, farmers preferred those traits that provided more financial benefits, showed less concern towards the aesthetic traits and showed their willingness to pay more for the desired attributes. The choice was horned goats, with black and white coat colour, larger body size, twining and more than one kilogram milk yield in females. The males with horns, black and white coat, large body size, not aggressive in temperament, with larger testes were the preferred choice in Beetal breed.

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