Marketing and Production Constraints of Dairy Goat Farmers in Limpopo Province of South Africa

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ABSTRACT
This study was conducted to understand the constraints faced by rural dairy goat farmers holistically in Limpopo Province, South Africa. Since goat production for milk is common in the study area, this study was conducted to assess the constraints (production and marketing) faced by the farmers and possibly offer solutions. A sample of 110 rural household dairy-goat farmers were randomly selected from ten villages of Sekhukhune District of the Province. Descriptive statistics and Probit regression model were used to analyse the data. The results revealed that majority of the farmers were female and were between middle and old aged. Most of them were married with secondary education being the highest educational level attained. They mostly keep an average of 4 goats per household, with social grant being their major source of income. Probit analysis revealed that safety of dairy goat and grazing pastures (Pr<0.025 and P<0.031 respectively) were major constraints of dairy goat production while breed improvement and milk processing (Pr<0.0001 and P=0.0001 respectively) were major constraints of goat milk marketing faced by rural household dairy goat farmers. Farmers were willing to enhance their dairy goat production for sustainable milk production if security of their animals and grazing pastures could be improved upon. Also advanced breed improvement and milk processing techniques if provided by government would greatly increase the production of the dairy goat milk in the study area.

Key words: Dairy goat, Kraal, Marketing, Probit function, Production, Women.

INTRODUCTION
Goats are the most essential traditional livestock kept by most rural households of South Africa; majorly for subsistence, commercial or both purposes (Donkin 1998; Chamboko et al. 2014). Studies have shown that rural households that keep goats for commercial purposes face lots of constraints in areas of marketing and production; especially lack of market infrastructure and middlemen; as they are usually sold as live goats for religious, traditional, or for other ceremonies such as weddings and parties as against batch production to meet large scale industrial needs. Other production constraints such as safety of the animals, proper breeding and veterinary services remain a challenge to the rural farmers in Gauteng and Northern Provinces of South Africa (Donkin 1998). Goat milk production in most cases is done purely for household consumption and less for commercial purposes due to constraints like unavailable storage facilities and marketing infrastructure (Chamboko et al., 2014; Mburu et al., 2014; Yangilar, 2013). Also goat’s milk availability in supermarkets and shops remain rare in rural areas, whereas other dairy products such as dairy is readily available, even though goats milk is considered a very healthy and nutritious milk product (Sagwe 2012). On the other hand, since dairy goats are less expensive to rear in relation to dairy cows and they produce just enough milk for household consumption and require smaller amounts of feed for maintenance; goat production for milk should be encouraged. Dairy goats also have relatively short generation interval requiring minimum management compared to dairy cows. All these makes dairy goats the most significant small ruminants’ rural household farmers can rear and benefit from more economically than dairy cows (Donkin 1998). Traditionally, most rural household goat farmers in South Africa keep their goats (dairy and chevon goats) in one kraal (housing) so as to reduce the major management costs of production in relation to other livestock’s (Maesela 2017). Therefore, dairy goat production could be a good means of alleviating poverty and improving the livelihood of people living in suburban areas of South Africa.

Probit regression model (PRM) analysis is used in survey studies to statistically identify relationships between dependent and independent variables probabilistically; where the dependent variables are binary (0 and 1) while the independent variables’ definite values are computed as probability values (Fernando 2011) for subsequent analysis. Probit analysis is based on the cumulative normal probability distribution where the binary dependent variable, y, takes on the values of zero and one (Aldrich and Nelson 1984). In this study, farmers having production and marketing constraints of dairy goats based on the independent variables identified, had the values of such probability computed and inputted in the PRM as the independent...
variables in order to identify their relationships with the dependent variable (production and marketing constraints). Therefore, this study was conducted in order to determine the major constraints (production and marketing constraints) faced by rural dairy goat farmers in Limpopo Province of South Africa using Probit regression model with the intention of finding ways to alleviate them.

**MATERIALS AND METHODS**

**Study area**

The study was conducted in Limpopo Province of South Africa, with Sekhukhune District being the area chosen purposively. Five of the local municipality that make up the District in the Province, include Elias Motsoaledi, Ephraim Mogale, Fetakgomo, Makuduthamaga and Greater Tubatse with river Olifants being the major source of water in all the localities. Limpopo Province generally has a sub-tropical climate with hot summers early in the year and mild to cold winters at the middle of the year; with average daily temperature in summer of 24°C and 12.8°C in winter. Furthermore, their average rainfall is 767 mm per annum, with approximately 10 times more rainfall in summer than in winter. The main economic activities in the district are crop farming, mining and livestock production particularly poultry production.

A purposive sampling technique was adopted in data-collection process, with two villages each selected from each of the local municipalities, while 3 villages were selected from Elias Motsoaledi Local Municipality (Table 1). Ten rural household dairy-goat farmers were sampled from each village selected; totalling 110 rural household dairy-goat farmers.

After briefing the farming households of the interviews and dates fixed, data was collected using structured questionnaires. Questions for the interview were both open and closed-ended, based on the availability of milking goats in the households. With open-ended questions, rural household dairy-goat farmers were enabled to state their own opinions, views and experiences in details, while, with closed-ended questions, rural household dairy-goat farmers were restricted to express their opinions and feelings in non-detailed form such as a yes or no answer. The interviews took place at every given dairy goat farmers’ household which were the units of data collection.

**Research hypothesis**

There were to sets of hypothesis set out for this study. They are

H0: There is no significant effects of the constraints on the production and marketing of the dairy goats’ products by the farmers in the study area.

H1: There is a significant effect of the constraints on the production and marketing of the dairy goat products by the farmers in the study area.

These hypotheses were tested using the probit regression model with probability levels set between 95% - 99.9%.

**Data formulation and methods**

Data were collected on production and goat milk processing and marketing management carried out by the farmers (Table 2). Data obtained from the questionnaire were coded and later imported into statistical software (SPSS 2015) for further analyses. Graphs and tables were also generated to summarize the results. Also, the Probit Regression Model (PRM) used with Likert scale (SPSS 2015) to categorise the wide variability of farmers identifying production and milk marketing constraints of goat farmers before the establishment of relationships between the dependent and independent variables. This is achieved by using a scale of 1 - 8 to indicate the level of constraints; with scores 5 to 8 classified as 1, whilst scores less than or equal to 4 classified as 0 (Fernando 2011); to form the dependent variables of the model with the mean values of the various independent variables computed for each respondent as well (Table 2).

In binary probit model, smooth production and marketing ability was taken as 1, while constrained production and marketing as 0. It is assumed that the ith household obtains maximum productivity and marketing, has good productivity and marketing than constrained ones. The probability (pi) of choosing any alternative over not choosing it can be expressed as in equation (2), where ϕ represents the cumulative distribution of a standard normal random variable (Greene 2011).

\[ pi = \text{prob}[Y \text{ is/are parameter(s)}] \]

\[ = \phi(x'\beta) \]

\[ \text{Eq. (2)} \]

Hence the Probit Model is as shown below (Eq. 3):

\[ Y = \text{Pr}(Y=1 | X) = \phi(x'\beta) \]

\[ \text{Eq. (3)} \]

Where Y is independent variable, Pr denotes probability, X = independent variable, ϕ is the Cumulative Distribution Function (CDF) and β is/are parameter(s).

Specifically, the regression model is estimated as:

\[ Yi = \beta_0 + \beta_1A + \beta_2G + \beta_3E + \beta_4S + \beta_5F + \beta_6P + \beta_7G + \beta_8GP + \beta_9MM + \beta_{10}LOMI + \beta_{11}AM + u_i \]

Where Yi = Dependent variable (either production or marketing constraints)

\[ \beta_0 = \text{Intercept on Y axis} \]

\[ \beta_1, \beta_2, \beta_3 = \text{Regression coefficient for independent variables - A, G, E, S, F, P, G, P, T, M, LOMI, AM respectively as explained in Table 2.} \]

\[ u_i = \text{Error term} \]

| Local Municipality        | Villages                        |
|---------------------------|--------------------------------|
| Fetakgomo LM              | Ga Matlala (Lepellane) and Malomanye |
| Greater Tubatse LM        | Thokwane and Moroke             |
| Makuduthamaga LM          | Malegale and Manganeng          |
| EphraimMogale LM          | Sevenstad and Moralela          |
| EliasMotsoaledi LM        | Manapsane, Moganyaka and Mamphogo |
RESULTS AND DISCUSSION

The demographic characteristics of participating farmers shows that 46.4% of participants were at age group 51-70 years showing that majority of the farmers were pretty old, while 0.9% of participants were aged ≤30 years and 44.5% were aged from 31-50 years (Table 3). Also more females (55.5%) than males (44.5%) rear dairy goats in the study area while marital status shows that married people (41.8%) were majority in the dairy goat farming enterprise, while 33.6% were single and 24.5% of them were widowed. The educational status of the participants shows that 32.7% never attended school, 13.6% attended up to primary level, while 35.5% attended up to secondary level; 18.2% attended up to tertiary level of education. The results further revealed that 16.4% of dairy-goat farmers receive monthly income from salaries (employment), whereas 1.8% receive from farming, 45.5% received from social grants, 7.3% from pension while 29.1% received from other sources of income (unemployed). The number of dairy goats kept by the rural farmers shows that 60% of the participants keep between 1 and 5 goats at a time, while about 36% were keeping between 6-15 goats at a time (Fig 1).

The production management characteristics of participating households indicate that 96.4% of participants were having one kraal while 3.6% had two kraals (Table 4). For the feeding management, 75.5% of the participants never fed their dairy goats with supplemental feeding rather grazed them on pasture, but 10.9% fed their dairy goats once per day with supplemental feeding and 13.6% fed them twice per day on supplemental feed.

The demographics of production and marketing constraints expressed by dairy goats’ farmers shows that 64.5% of them were facing production constraints while 35.5% had none, while 34.5% were constrained in goat milk processing and marketing and 63.5% faced no constraints (Table 5). Furthermore, 48.2% of participants were sure of the safety for their dairy goats against predators and thieves, while 51.8% reported that their dairy goats were not safe from predators and thieves.

For the marketing constraints faced by the dairy goat farmers; only 34.5% of participants milched their dairy goats, while 65.5% did not. Hence the marketing constraints of goat milk are faced by only the 34.5% of farmers that milch their goats.

The Probit regression analysis showed that safety (\( \epsilon \), 0.232; 0.025) and grazing pastures (\( \epsilon \), 0.322; 0.031) were significant constraints that influence dairy goat production in the study area while breeding (\( \epsilon \), 2.561; sig 0.000) and milk processing (\( \epsilon \), 2.342; sig 0.000) are significant variables that have influence on milk processing and marketing (Table 6).

Demographics and production management distribution of farmers

Results of the demographics and production management distribution of farmers showed that the majority of the farmers (46.4%) were of the age group 51-70 years. This shows that dairy-goat production and goat-milk marketing was an activity of adults and was hardly practised by the youth in the research area. Similar results had been reported by (Donkin 1998) where he postulated that dairy goat keeping was an aging activity and is rarely practised by youths. However, with the result of females dominating the dairy goat production and milk marketing, it negates the findings of Tesfaye and Tamir (2015) who reported that men, instead of women, engaged in most of goat-marketing operations in Ethiopia such as purchase and sale, as well as breeding-related decisions, while women play the important role of milking of dairy goats and caring for sick animals. Also this was in line with reports of Yusoff, et al., (2016) who observed that men were more likely to be engaged in small ruminant farming than women in Kenya. The reason for this gender
### Table 3: Demographics of the participating dairy goat farmers.

| Variables            | Descriptive | Frequency | Percentage |
|----------------------|-------------|-----------|------------|
| Age                  | Less than 30 years | 1          | 0.9%        |
|                      | 31-50 years    | 49        | 44.5%      |
|                      | 51-70 years    | 51        | 46.4%      |
|                      | 71-90 years    | 9         | 8.2%       |
| Gender               | Female        | 61        | 55.5%      |
|                      | Male          | 49        | 44.5%      |
| Marital status       | Single        | 37        | 33.6%      |
|                      | Married       | 46        | 41.8%      |
|                      | Widowed       | 27        | 24.5%      |
| Educational level    | No Schooling  | 36        | 32.7%      |
|                      | Primary       | 15        | 13.6%      |
|                      | Secondary     | 39        | 35.5%      |
|                      | Tertiary      | 20        | 18.2%      |
| Source of income     | Salary        | 18        | 16.4%      |
|                      | Farming       | 2         | 1.8%       |
|                      | Social Grant  | 50        | 45.5%      |
|                      | Pension       | 8         | 7.3%       |
|                      | Other         | 32        | 29.1%      |

### Table 4: Demographics of the production management of participating farmers.

| Variable                        | Descriptive | Frequency | Percentage |
|---------------------------------|-------------|-----------|------------|
| Number of kraal                 | One         | 106       | 96.4%      |
|                                 | Two         | 4         | 3.6%       |
| Feeding supplemental diets      | Never       | 83        | 75.5%      |
|                                 | Once        | 12        | 10.9%      |
|                                 | Twice       | 15        | 13.6%      |

### Table 5: Demographics of Production and Marketing Constraints of Dairy Goat farming.

| Variable                        | Range | Frequency | Percentage |
|---------------------------------|-------|-----------|------------|
| Dairy goat production constraints| Yes   | 71        | 64.5%      |
|                                 | No    | 39        | 35.5%      |
| Feeds purchase                  | Yes   | 26        | 23.6%      |
|                                 | No    | 84        | 76.4%      |
| Feeds Affordability             | Yes   | 18        | 16.4%      |
|                                 | No    | 92        | 83.6%      |
| Feeds shortage                  | Not available | 15      | 13.6%      |
|                                 | Sometimes | 36    | 32.7%      |
|                                 | Always    | 59        | 53.6%      |
| Safety                          | Safe   | 53        | 48.2%      |
|                                 | Not safe | 57      | 51.8%      |
| Cleanliness                     | Yes    | 50        | 45.5%      |
|                                 | No     | 60        | 54.5%      |
| Veterinary health service       | Yes    | 16        | 14.5%      |
|                                 | No     | 94        | 85.5%      |
| Grazing land                    | Yes    | 103       | 93.6%      |
|                                 | No     | 7         | 6.4%       |
| Grazing Pastures                | Yes    | 13        | 11.81%     |
|                                 | No     | 97        | 88.18%     |
| Breeding                        | Yes    | 2         | 1.8%       |
|                                 | No     | 108       | 98.2%      |
inequality in dairy-goat farming among the participants in the study area was not known. However, it was possible that, because women were responsible for food availability in the households of the study area, they engage more in dairy-goat production and goat-milk marketing in order to raise more money for their households’ upkeep. Meanwhile, with the majority of participants being married; this was expected since dairy-goat production and goat-milk marketing was an activity that requires efforts or support system from every member of the family. Sagwe (2012) found similar results in the Borabu District, of Nyamira County in Kenya and posited that marital status has influence on the commercialization and marketing of goat milk. The educational level of the participants also show high level of education attained (secondary school level) by the majority of the farmers. This was in line with the findings of Sagwe (2012) and Byaruhanga et al. (2015) who reported that high literacy levels were expected to enhance goat production and market participation as well as the adoption and practicing of new technologies that will enhance dairy-goat productivity and market participation. With very low number of participants (1.8%) receiving monthly income from dairy goat farming, it implies that it played a limited role as source of income contribution of rural households who participated in the study. These findings were in disagreement with the finding of Byaruhanga et al. (2015) who reported that 92.1% of household farmers in Uganda ranked dairy goat farming as their first livelihood activity. This could be because the people of the research area did not actively participate in goat milk usage.

With the majority of participants (60%) in the present study reporting that they kept less than five dairy goats at a time (the mode of the distribution was four dairy goats), it supported the findings of researchers elsewhere. Shinde (2011) reported a 70% distribution of rural household goat farmers keeping 1-3 dairy goats in the Solapur District of Maharashtra State of India. The 70% reported by Shinde (2011) is slightly higher than the 60% reported in the present study. However, both findings confirm the fact that the majority of rural households keep less than five dairy goats. In the present study, 96.4% of the participants keep their dairy goat in one kraal. This result was, however, inadequate and unexpected as it was thought that kraals were expected to be at least two for each farmer in order to make

![Fig 1: Distribution of Number of Dairy Goat Kept by Rural Household Farmers.](image)

**Table 6:** Estimates of Probit regression model on factors influencing production, milk processing and marketing constraints of dairy-goat farmers.

| Parameter               | Estimate | Std. Error | Z    | Sig  | 95% interval | Confidence Bound |
|-------------------------|----------|------------|------|------|--------------|-----------------|
| Age                     | .001     | .003       | .055 | .956 | -.007        | .007            |
| Gender                  | .049     | .099       | .490 | .624 | -.146        | .243            |
| Number of Dairy Goats   | -.004    | .011       | -1.318 | .751 | -.026        | .019            |
| Veterinary Health Service | -.553  | .295       | -1.806 | .071 | -1.112       | .046            |
| Safety                  | .232     | .103       | 2.244 | .029 | .029         | .435            |
| Grazing Land            | .797     | .369       | 2.162 | .191 | .075         | 1.520           |
| Grazing Pasture         | .322     | .052       | 1.567 | .031 | .043         | 1.765           |
| Breeding                | -2.22    | 436.033    | -0.005 | .996 | -856.830     | 852.389         |
| Cleanliness             | -.064    | .103       | -0.621 | .534 | .266         | .138            |
| Breeding                | 2.561    | .701       | 3.652 | .000 | 1.186        | 3.935           |
| Cleanliness             | .081     | .154       | .523  | .601 | -.222        | .383            |
| Milk processing         | 2.342    | .552       | 4.240 | .000 | 1.259        | 3.424           |
| Storage facility        | -.299    | .189       | -1.527 | .127 | -.660        | .082            |
| Supplemental feeding    | -.124    | .185       | -0.669 | .503 | -.485        | .238            |
| Intercept               | -3.390   | .465       | -7.284 | .000 | -3.855       | -2.924          |
| Chi-Square test         | Chi-Square | Df | Sig  |      |              |                 |
| Pearson goodness-of-fit test | 136.489 | 100       | .009 |      |              |                 |
Production constraints

Production constraints of dairy-goat enterprise were experienced by the majority of the participants as indicated by 64.5% of participants. These findings might suggest that there is a gap of improvement that is still required in running dairy-goat production in the study area. Although the reason for this huge number of participants facing dairy-goat production constraints is not known, however, it might be attributed to the low level of information on dairy goat farming. On the other hand, only 35.5% reported that they were not facing any constraints in running their dairy-goat production. This number was very low and needed to be improved upon possibly with the assistance and intervention of extension officers. This was also corroborated by the high number of participants (76.4%) that did not buy supplementary feeds for dairy goat, while 83.6% of participants indicated that they failed to buy feeds because of the high cost of dairy feeds. This result was expected and it was a true reflection of the economic situation among the participants in the study area, since the majority of the farmers only receive major income from social grants. Often, income from Social Grants are used for the purchase of family needs, with little or none left for the purchase of dairy-goat feed, hence limiting their purchasing power. Similar findings were also reported by several other researchers (Inderpreet et al. 2011; Sonpasare et al. 2011; Chamboko et al. 2014). These authors found that the high cost of supplementary concentrates is a major limitation to feeds purchase for dairy goats. However, Mrema and Rannobe (1996) reported that feed shortage generally was the major problem faced by goat farmers in rural areas of Tigray, Ethiopia.

More than half of the participants 51.8% reported that the safety of dairy goats remained the major challenge in running their dairy-goat production enterprise because wildlife predators and thefts remain rampant. These results were not surprising as the majority of the participants allowed their dairy goats to scavenge and feed on the natural pastures without herders. Similar results were also found by Jana et al. (2016) who reported that complaints by neighbours and attack by predators were the major safety issues faced by farmers in their goat-production enterprise.

Marketing constraints

Since over 65.5% of dairy-goat farmers in the present study did not milk their goats hence did not experience milk processing and marketing constraints, 34.5% of participants who regularly milked their goats indicated that they experience goat-milk processing and marketing challenges. Similar findings had been reported in Zimbabwe by Chamboko et al. (2014) who observed that households do not milk dairy goats because they did not consume goat milk. Among the participants who milked their goats, milching techniques appeared to be a critical factor constraining marketing of goat milk. While majority of the participants (34.5%) in the present study reported that they use traditional method (hand milking) to milk their dairy goats while the rest did not use any other method. Perhaps the reason for this was because they were not exposed to effective and efficient technologies that could best be used to enhance milking of high quantities of goat milk. Yangilar (2013) reported that it was not milking techniques only that have an influence on goat-milk marketing constraints, but the poor conditions in which goats were milked which effectively influence marketing of such goat milk. Also the goat-milk processing and storage facilities were among the marketing constraints reported by participating farmers. Rural household dairy-goat farmers in the study area indicated that they cook goat milk (pasteurization) before consumption (92.1%), whereas 7.9% of participants consume raw milk. The fact that this percentage of participants consumed unprocessed raw milk was highly worrisome because it was important to get fresh milk boiled or processed before consumption, to kill naturally occurring bacteria that could cause diseases. Similar results were also found by Surkar et al., (2014) in the Taluka District, India.

Probit Regression Model Test on production and marketing constraints

The Probit regression model has a statistically significant Chi-square effect (P<0.05) which gives it an acceptable goodness-of-fit as the appropriate model. Out of the nine independent variables studied, two were significant (P<0.05) for production constraints while out of eight for marketing constraints, two were significant (P<0.05). The safety of dairy goats and grazing pastures were variables with significant (P<0.05) effects on production constraints; while breeding of dairy goats and milk processing methods remain the statistically significant (P<0.05) variables that influence marketing constraints in the study area. The safety of dairy goats being a major constraint in dairy goat production in the study area, means that for every unit increase in the safety of dairy goat, there will be an amelioration in the production constraints of the dairy goats. Majbritt (2015) posited that adequate housing and proper herding remains
the major principle enhancing safety of dairy goat in dairy-goat production enterprise in the study area. Also grazing pastures when readily available can be a good source for ameliorating production constraints faced by the farmers. However, with increased shrinking of grazing pastures due to global warming, over grazing and other factors, it could result in making the reduction of the constraint very difficult to achieve. (Rajkumar and Kavithaa 2014) observed that the shrinking of grazing pastures or lack of grazing land, which was ranked first as major constraint in goat production by participants in the Erode District of Tamil Nadu, India; appeared to be the most important cause of increased production constraint to dairy-goat production. Therefore, possible creation of grazing reserves by governments or the utilization of otherwise arable lands for pasture cultivation could be a viable solution to this challenge.

Breeding of dairy goats which has a positive and significant (P<0.05) effect on the marketing constraints of goat milk in the study area, implies that without proper breeding strategies applied to the dairy flock of goats, their milking ability over the years will continue to depreciate. Mrema and Rannobe (1996) observed that a large numbers of animals kept without proper mating and breeding programme to counter inbreeding effects, results in depressed production of milk and general poor performance of the flock. Milk processing being another factor influencing marketing constraints of goat milk in the study area shows that because of the lack of proper and adequate milk processing techniques adopted by the farmers, the marketability of the product is affected. However, due to the fact that the processing of goat milk enhances milk quality with long shelf-life span and increased cost of production; this increased cost therefore makes processed goat milk to be more expensive to the consumers and end up not being purchased, thereby being a major constraint (Djekic et al. 2014). Zereu et al. (2016) indicated that household farmers did not consume milk due to different cultures, lack of awareness of the importance of goat milk and high amount of milk produced by goats. Yangilar (2013) also posited that poor conditions in which goat milk was processed and poorly handled milk could be a major barrier in its marketability.

CONCLUSION

It has been established that dairy goat production and goat milk marketing in Limpopo province is practised more by women than men even as this activity is rarely practised by youths. Dairy goats in the Sekhukhune District rely more on natural pastures and less on supplementary feeds for their survival with the majority of the farmers keeping four dairy goats in one kraal. Further to this, the results of the Probit analysis reveals that safety of dairy goat and grazing pastures are major constraints of dairy goat production, while breeding and milk processing are major constraints of goat milk processing and marketing faced by rural household dairy goat farmers.

Therefore, in order to enhance the productivity of dairy goat production and goat milk marketing in the study area, the government and agricultural extension services should assist the rural farmers by improving on the constraints identified in this study which would in turn significantly improve the productivity of the farmers as well as boost the economy and health of the society indirectly.

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