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Smallholder Dairy Farmers' Breed and Cow Trait Preferences and Production Objective in JimmaTown, Ethiopia

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Abstract: Farmers' breed and trait preferences and production objectives are very important in genetic improvement programs. The objectives of this study was to assess smallholder dairy farmers' breed and cow trait preferences, production objectives and breeding practices in Jimma town, Oromia Regional State, Ethiopia. Data were obtained by interviewing 54 randomly selected smallholder dairy farmers using structured questionnaires. Results indicated that majority of the respondents (94%) producing milk as a source of income was the primary purpose of keeping dairy cattle. Over 90% of the respondents kept crosses of Holstein x indigenous Zebu. Farmers kept significantly ($P<0.05$) larger number of crossed than indigenous cattle (14.32±1.78 vs.1.81±3.25). All the respondents showed high preferences for crossbred cows due to their high milk production. Listed cow traits of farmers' preferences were milk fat, fertility, growth rate, lactation length, milk yield, longevity and adaptation. Milk yield (mean index rank=0.25) was highly ranked for crossbred dairy cows followed by high fertility (0.24) and long lactation length (0.22), whereas milk yield (mean index rank=0.26) followed by adaptation (0.25) and high fertility (0.21) were farmers' high ranked traits of indigenous cows. Milk fat was considered the least preferred trait. Milk production, fertility, lactation length and adaptation were the most preferred cow traits which farmers would like mostto be improved. Natural mating was found to be the widely used breeding method and use of AI services was uncommon. Culling and record keeping was practiced by 68.5% and 40.7% of the farmers, respectively. Poor bull, lack of artificial insemination (AI) services, low conception rate, inadequate heat detection and distance to the bull were stated to be the most important constraints to breeding cows. It is concluded that for improved dairy production, participatory genetic improvement programs that take into account farmers' breed and trait preferences, traditional knowledge and perceptions on breeds and traits of choice would be important.

Key words: Adaptation · Breed and Cow Trait Preferences · Crossbred Cow · Indigenous Cow

INTRODUCTION

Ethiopia holds the largest cattle population in Africa estimated at about 53.4 million heads of cattle [1], of which 12.5% are used for milk and 10 million is estimated indigenous dairy cows yielding 3.2 billion liters/annum[2]. Despite, the large dairy cattle population, mean per capita milk consumption is about 16 kg/year, which is much lower than African and world per capita average of 27 kg/year and 100 kg/year, respectively [3]. This average is also very low when compared with that for sub-Saharan Africa, which is estimated at 30.8 kg per capita.

In Ethiopia, the annual growth rate in milk production (2.1%) falls behind the annual human population growth rate of 3.4% [4]. This shows milk production from indigenous animals is very low due to several technical, institutional and infrastructural constraints. The poor genetic potential, inadequate nutrition and poor animal health care and management practices are the main

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contributors to the low productivity of livestock in Ethiopia [5]. To realize improvement in milk production these constraints would need to be alleviated.

Purposes for which cattle were kept resemble more or less the breeding objectives farmers had for cattle [6]. However, the breeding goals of livestock keepers were often multifaceted and were mainly driven by the underlying production system [7, 8].

In Ethiopia, market-oriented urban and peri-urban milk productions are flourishing as main suppliers of milk and milk products to cities [13]. In the present study area, smallholder urban dairy farming is emerging as promising economic activity in response to rapidly increasing demand for milk and dairy products by urban consumers in Jimma town. Identifying local knowledge of breed and trait preferences of farmers is the starting point to define and set up appropriate breeding goals that can address the interest of the smallholder farmers [10, 14]. However, there is little or no documented information on farmers' breed and trait preferences, purpose of dairy farming and breeding practices in the present study area. Therefore, the aim of this study was to assess smallholder dairy farmers' breed and cow trait preferences, purpose of dairy farming and breeding practices in Jimma town, Ethiopia.

MATERIALS AND METHODS

Study Area: This study was conducted in Jimma town of Jimma Zone, Oromia Regional State, Ethiopia. The study area is located at Latitude 7°4' N and Longitude 36°50' E and at an altitude of 1704 m above sea level, 352 km southwest of Addis Ababa. The area has sub-humid tropical climate. The average annual rainfall ranges from 1200 to 2000 mm, having a bimodal pattern. About 70% of the total annual rainfall is received during the main rainy season, which lasts from June to September. The short rainy season extends from March to May. The dry season lasts from October to February. The average annual minimum and maximum temperatures are 25°C to 30°C, respectively [15].

Sampling Procedure: A simple random sampling technique was used for selecting sample farmers. The target population was defined as all smallholder dairy farmers in Jimma town who owned dairy farms. A list of the dairy farmers was obtained from official records maintained by the JimmaTown Multipurpose Dairy Development Private Limited Company (JMDDPLC). The number of households sampled was determined by $N=0.25/SE^2$, where N=number of sampled households, SE=standard error [16]. Considering standard error of 6.8% with 95% CI as follows, $N=0.25/ (0.068)^2 = 54$. Then, a total of 54 smallholder dairy farmers were randomly selected from a list of JMDDPLC and individually interviewed. Before the formal survey/interview, a preliminary visit was made by the first author and one employee of the dairy cooperative to get the consent of the farmers, locate the farms and to give a brief description to each respondent on our research objectives and potential use of involving in the study.

Data Collection and Analytical Technique: A single-visit-multiple-subject formal survey approach[17] was used to collect data from 54 smallholder dairy cattle producers through household interviews, conducted in the local languages by the first author using a pre-tested structured questionnaires and personal observation. The questionnaire was prepared in English and translated into the local 'Afaan Oromo' and 'Amharic' languages by the researcher, who is a fluent in both local languages. Data obtained from the interview was on farmers socio-economic profile, reasons for keeping dairy cattle, sources of foundation stock, breed of cattle, herd size and structure, farmers' breed and cow trait (milk fat, fertility, growth rate, lactation length, milk yield, longevity and adaptability) preferences, milk production, breeding practices, record keeping and culling reasons.

The computer software Excel was used for data management and entry. The Statistical Package for Social Sciences (SPSS) software version 16.0 computer programs was used for data analysis. Descriptive statistics such as means, frequencies and percentiles were used to summarize data. An index ranking was calculated to quantify farmers' cow trait preferences for crossbred and indigenous cows according to the formula: Index = Σ of (6 x proportion of response for first rank + 5 x proportion of responses second rank+ 4 x proportion of responses for third rank + 3 x proportion of responses fourth rank + 2 x proportion of responses for fifth rank+ 1 x proportion of response sixth rank given for particular trait)/ sum of (6 x total response for first rank + 5 x total responses for second rank+ 4 x total responses for third rank + 3 x total responses fourth rank + 2 x total responses for fifth rank + 1 x total response for sixth rank given for particular trait).

RESULTS AND DISCUSSION

Socio-Economic Profile of Respondents: Table 1 shows respondents' socio-economic characteristics in the study area. The majority of the respondents (75.9%) were male,

Table 1: Socio-economic profile of smallholder dairy farmers in Jimma town

Variables	Frequency	Mean ± SD
Age	54	51.26 ± 10.99
Family size	54	6.02 ± 2.52
Gender		
Female	13	24.1
Male	42	75.9
Education, %		
Illiterate	1	1.9
Elementary school	11	20.4
Junior high school	6	11.1
Senior high school	13	24.1
College	19	35.2
University	4	7.4
Occupation, %		
Traders	11	20.4
Civil servant	14	25.9
Pensioner	14	25.9
Dairy farmer	9	16.7
House wife	6	11.1

which is in agreement with results of Azage [18] in Addis Ababa and Yitaye [19] in northwest Ethiopia. The mean age and family size of the respondents was 51.26±10.99 years and 6.02±2.52 persons, respectively. The results indicate that dairying farming was generally run by people of old age. The family size obtained in the present study was lower than the findings of Asaminew and Eyasu [20], who reported the mean of 8.2 and 7.2 persons in Bahir Dar Zuria and Mecha woredas, respectively. The interviewees stated that large family size was very important source of labour for dairy activities.

The majority (42.6%) of the farmers had college and university education and was higher than the findings of Yousuf Kurtu [21] who reported that 24% of the respondents in Harar milk shed in Ethiopia had college and university education. Being more educated farmers indicates easy adoption of new technologies, using extension messages and training for improved dairy production. Over 96% of the farmers had no land and dairying was practiced using family residential compounds. This is in agreement with previous studies [13, 19, 22-24] who reported that over 80% of urban dairy farmers in other parts of Ethiopia had no access to land and use their residential compound for dairy farming.

Only 16.3% of the respondents were full-time dairy farmers and 83.7% were also engaged in various off farm economic activities such as 20% traders, 26% public servants, 26% pensioners and 11.1% were housewives.

Herd Size and Structure: Table 2 illustrates the mean herd size and structure of dairy cattle of respondents. Most of the respondents (90.80%) kept predominantly

Table 2: Mean (±SD) herd size and structure per household in Jimma town

Herd structure	Crossbred	Local zebu
Lactating/milking cows	3.76±3.08[a]	0.35±0.73[b]
Dry cows	2.72±2.17[a]	0.37±0.77[b]
Male calves (1-6 months)	1.70±1.80[a]	0.28±0.60[b]
Female calves (1-6 months)	2.20±1.92[a]	0.09±0.59[b]
Pregnant heifers (> 1 year)	0.89±1.27[a]	0.04±0.19[b]
Young heifers (6-12 months)	1.52±1.71[a]	0.22±0.92[b]
Bulls	0.35±0.55[a]	0.02±0.14[b]
Overall mean	14.32±1.78[a]	1.81±3.25[b]
Milk production/cow/day	8.52±3.04[a]	2.12±0.68[b]
Milk production/household/day	36.43±32.74	3.87±0.39

Means within rows with different superscript letters differ significantly at P<0.05

crossbred dairy cattle (Holstein x indigenous). Similar results have been reported by previous workers [13, 18, 23] in different parts of Ethiopia. The farmers kept a significantly higher (P<0.05) number of crossbred than indigenous cattle (14.32±1.78 vs.1.81±3.25) per household. Breeding females comprised the largest group of the herd. The mean number of crossbred dairy cows per household obtained in this study was higher than the findings of Asaminew and Eyasu [20] in the northwestern Ethiopia. The milking cows (3.76±3.08) constituted the largest group of the herd, which is in agreement with the findings of Asaminew and Eyasu [20] in other part of Ethiopia. Breeding bulls made up the smallest number (0.35±0.55) of the total herd. This suggests that male calves are culled to avoid competition for feed with breeding females.

The average milk production/cow/day and per household/day was 8.52±3.04 and 36.43±32.74 liters, respectively. Milk off take/cow/day was generally low despite the potential of the crossbreeds. This could be due to seasonal feed shortage in terms of quality and quantity, poor disease control and management practices. The respondents stated they had no access to adequate extension services and training on dairy production and management.

Reasons for Keeping Dairy Cattle: Table 3 shows farmers' reasons for keeping dairy cattle in the study area. Majority of the farmers (94.4%) stated that milk production for income generation is the primary reason for keeping dairy cattle. The dairy farmers indicated that an increase in milk yield per household would increase their income and home-consumption resulting in improved livelihoods. The results of this study was in agreement with previous findings of Sintayehu *et al.* [13], who reported that for 74.2% of urban dairy farmers in southern Ethiopia, the purpose of dairying was to produce milk as a source of income.

Table 3: The major purposes of keeping dairy cattle by dairy farmers in Jimma town

Variables	Frequency	Percentage
Reasons for keeping dairy cattle		
Source of income	51	94.4
Risk mitigation (insurance)	2	3.7
Milk consumption and income	1	1.9
Sources of crossbred foundation stock		
Use of AI	1	1.9
Purchased cow	50	92.6
Purchased bull	1	1.9
Project support	2	3.7

In the present study area, a growth in urban population, per capita income and urbanization has resulted in increasing demand for milk and milk products. To use this opportunity, smallholder farmers from different occupational backgrounds engaged in dairy farming in their residential compound as the main and/or supplementary source of income. According to Rewe *et al.* [25], knowledge of reasons for keeping animals is prerequisite for deriving operational breeding goals. Piotr *et al.* [26] reported that recently the purpose of cattle keeping are focused on the increase of milk yield, under the assumption that profit would increase with increased yield per cow.

With regard to sources of crossbred foundation stock, over 92% of the farmers purchased crossbred cows, 3.7% obtained from project support, 1.9% purchased crossbred bull for upgrading their indigenous cows and the rest 1.9% respondents crossbred their indigenous cows through artificial insemination (AI).

Breeding Practices: Table 4 shows the breeding method and heat detection practice in the study area. The study revealed that natural service (100%) was the widely used breeding method and AI service was uncommon. This was due to lack of access to artificial insemination (AI) services. Contrary to this finding, Emebet and Zeleke [27], Yitaye [28] and Sintayehu [13] indicated that 69.7%, 57% and 50% urban smallholder dairy farmers in different parts of Ethiopia used AI service, respectively. It was found that, even though all the respondents used natural mating, majority (74.1%) of them have no breeding bulls. Thus, farmers shared or hired bull from neighbors on payment basis. The bull fee per service varied from 25 and 50 Ethiopian birr (ETB), which is about US$ 1.5 to 3 at the time of this study. The payment is made only for the bull service at estrus regardless of the cow will be conceived or not.

Table 4: Breeding practices and estrus detection methods used by dairy farms in Jimma town

Variables	Frequency	Percentage
Breeding method		
Artificial insemination (AI)	0	0
Natural	54	100
Reasons for not using AI		
Lack of access	54	100
Source of bull		
Own	14	25.9
Shared	40	74.1
Methods of estrus detection		
Observation by farm workers and family	2	3.7
Bull	1	1.9
Signs of estrus manifested by a cow	7	13.0
Do not practice	44	81.5

The sharing of breeding bull could attribute to the possible incidence of getting reproductive diseases, since farmers had no any control measures against sexually transmitting diseases before using available bulls for mating. In addition, the use of own bred bull within the herd for a long time could increase the chance of inbreeding. Thus, farmers need to be trained not to maintain own bull for a longer time as there is a chance of mating with their daughters and increase inbreeding within the herd. Bebe *et al.* [29] reported that increased inbreeding and the use of unproved bulls and inadequate artificial insemination services may have unfavorable long-term effects on productivity through the degradation of the herd genotype. Few farmers stated that they practice back-crossing of their crossbred cows with indigenous bulls when they have no access to crossbred bulls.

Most of the respondents (81.5%) did not practice heat detection (Table 4). Those respondents who practiced heat detection observe their cows when they are in heat by the swelling, mucus discharge and redness of vulva and restlessness, frequent bellowing, loss of appetite and reduced milk yield. This is in agreement with previous works of Nuradis *et al*. [30] in Jimma Zone, Ethiopia. According to Mukasa-Mugerwa [31] and Radostitis *et al*. [32], the greatest limiting factor to successful fertilization and reproductive performance is associated with detection of estrus. Lack of breeding bull and artificial insemination services, poor detection of estrus and missed insemination, low conception rate and distance to bulls were the most important breeding constraints stated by the respondents.

Breed Preferences: Farmers' breed preferences in the study area are shown in Table 5. The results revealed that almost all of the respondents (100%) in the surveyed area

Table 5: Frequency of dairy farmers' breed preferences in Jimma town

		Reasons for preference of a breed (%)		
Breed	Frequency	Milk yield	Lack of access to other breeds	For cross-breeding
Crossbreeds	54	100	0	0
Indigenous breed	21	0	38.9	38.9

showed preferences for crossbred animals. This was found to be in line with their objectives of dairy farming, which was milk production for income generation. Majority of the farmers (94.4%) reported that the reasons behind the preference of crossbreds were milk production, growth rate and better reproductive performance. However, despite their high productive and reproductive attributes, crossbreds were negatively viewed by the respondents for their high cost of rearing, susceptibility to diseases, high feed and management demand.

On the contrary, all the respondents who kept indigenous breed mentioned that the reason for preferences of indigenous breed was lack of access to improved breeds. They stated that if they get access to improved breed, they would shift to breeding of crossbred animals. Financial limitations and lack of support was the most important reason for keeping indigenous breeds only.

The desirable attributes of indigenous cattle as stated by the farmers were easy management, high milk fat, less risk to diseases, low feed requirement and tolerance to heat and drought. This is in agreement with the findings of Takele *et al.* [33] in other part of financial limitations and lack of support Ethiopia. Despite these merits, respondents mentioned that indigenous breed had low productive and reproductive performances, even when kept under the same management level with crossbred animals. Janssen-Tapken *et al*. [34] reported that the selection of the specific breed is mainly due to its adaptability to harsh environmental conditions and disease challenges and difficult access to other breeds.

Cow Trait Preferences: Farmers' cow traits preferences for crossbred and indigenous dairy cows in the study area are presented in Table 6. Results of the present work showed that milk yield (mean index rank=0.25) of crossbred cows was farmers' most preferred trait followed by fertility (0.23), lactation length (0.22), longevity (0.14), growth rate (0.12) and milk fat (0.04). This shows that farmers in the surveyed area would prefer to have crossbred cows with high milk production, high fertility and long lactation length. The high rank assigned to milk yield corresponds to the primary reason for keeping dairy cattle in the surveyed area. In addition, the strong emphasis given to milk yield shows its influences on farmers' future selection of cows for milk production. In this study, farmers showed least preference for milk fat of crossbred cows, thus it would have less influence on their decisions of trait improvement.

In the present study, milk yield (mean index rank = 0.260), adaptation (0.25), fertility (0.21), growth rate (0.12), lactation length (0.10) and milk fat (0.06) were ranked as

Table 6: Reported ranking of farmers' cow trait preferences in Jimma Town (higher numbers of index indicate most preferred trait)

	Rank of preferred traits of crossbred cows						
Traits	1st	2nd	3rd	4th	5th	6th	Index
Fat yield	0	0	0	0	3.7	79.6	0.04
Fertility	3.7	27.7	70.3	11.0	1.9	1.9	0.23
Growth rate	3.7	5.6	3.7	13.0	75.9	0	0.12
Longevity	0	9.3	9.3	59.3	11.1	11.1	0.14
Milk yield	85.2	0	3.7	0	0	0	0.25
Lactation length	7.4	57.4	13.0	16.7	7.4	7.4	0.22
Total	100	100	100	100	100	100	1.00
Rank of preferred traits of indigenous cows							
Fat yield	0	0	0	4.5	18.2	78.3	0.06
Fertility	0	13.6	87.0	0	9.1	0	0.21
Growth rate	0	0	0	81.8	0	8.7	0.12
Milk yield	14.3	81.8	4.3	9.1	0	8.7	0.26
Adaptability	85.7	0	0	0	0	0	0.25
Lactation length	0	4.5	8.7	4.5	72.7	4.3	0.10
Total	100	99.9	100	100	100	100	1.00

Index = the Σ of (6 for rank 1 + 5 for rank 2 + 4 for rank 3 + 3 for rank 4 + 2 for rank 5 + 1 for rank 6 given for individual reason divided by the sum of (6 for rank 1 + 5 for rank 2 + 4 for rank 3 + 3 for rank 4 + 2 for rank 5 + 1 for rank 6) summed over all reasons.

the most important traits of farmers' preferences for indigenous cows. Similar findings on ranking milk yield first by dairy farmers were reported [33, 35] in Ethiopia and Mwacharo and Drucker [14] and Lanyasunya *et al*. [36] in Kenya. In contrast to the result of this study, fertility was ranked first by farmers in Shei-Bench farmers in Ethiopia [33] and Ankole cattle keepers in Uganda [37].

In both indigenous and crossbred cows, farmers tended to select breeding cows predominantly linked to traits of high milk production followed by fertility and adaptability. Therefore, in a breeding program farmer' preferences, knowledge and perception for preferred traits should be taken into account. According to Solkner *et al.* [38], lack of participation of livestock keepers and other stakeholders in planning, execution and decision making process of livestock improvement programs is one of the major causes of failure of such programs. According to Mekonnen *et al*. [39], breeding programs should be geared towards top ranked functional traits and management practices such as better feeding and health should go in line with genetic improvement programs. In the present study, farmers produce milk mainly for income generation. Thus, market demand and use of dairy products should also be taken into account while formulating breed improvement programs.

Practice of Record Keeping: The types of farm records kept by the dairy farmers are shown in Table 7. An efficient recording system is very important for any breeding program to evaluate the performance of the animal. Galal [40] defines animal recording as an activity that involves the measurement of various indicators of animal performance and the use of that information in the decision making process. Flamant [41] expands further on this and defines it as a process dedicated to the collection of information on animals, completed by its processing, interpretation and dissemination of the results in a perspective of decision making for choosing breeding animals for future generations. In this study, majority (59.3%) of the farmers have notany recording.

Table 7: Practice of record keeping by urban dairy farmers in Jimma Town

Variable	Frequency	Percentage
Practice of record keeping		
Farmers practicing	22	40.7
Farmers not practicing	32	59.3
Types of records kept		
Breeding	3	5.6
Milk yield	15	27.8
Breeding, health, milk yield and feed	4	7.4

Table 8: Frequency of reasons for culling animals by dairy farms in Jimma Town

Variables	Frequency	Percentage
Practice of culling		
Yes	37	68.5
No	17	31.5
Reasons for culling		
Old age	5	9.3
Poor fertility	4	7.4
Mastitis	9	16.7
Low production	8	14.8
Frequent abortion	1	1.9
Feed shortage	2	3.7
Financial need	9	16.7
Limited space	1	1.9

Of those farmers who kept records, most (25.9%) of them kept milk production record only, while 13% had breeding, milk production, health and feeding records which were not well organized. Similar results were reported by Sintayehu *et al.* [13] who stated that 79% of the smallholder urban dairy farmers in southern Ethiopia did not keep any farm record. Record keeping is a very crucial management practice in dairy farm profitability. Thus, this study suggests that farmers should be encouraged through extension services and training to practice record keeping for breed improvement decisions and increased milk production.

Culling Practices: Reasons for culling animals are shown in Table 8. Culling was one of the management practices in the study area. Most of the farmers (68.5%) practiced culling of animals. Reasons for culling were old age, poor fertility, low production, mastitis, feed shortage and need for cash. Mastitis and financial needs (16.7% each) accounted for the largest proportion of cattle exists. In agreement with this study, Emebet and Zeleke [27] reported that in Dire Dawa smallholder dairy farming, the causes of culling were low production, feed shortage, health and financial requirements.

CONCLUSIONS

This study identified the purpose of dairy keeping, breeding practices, farmers' breed and cow trait preferences. The most important reason for keeping dairy cattle was as a source of income from sale of milk. Most of the respondents showed high preferences for crossbred over indigenous cattle due to their high milk production. Farmers gave high preference for milk yield, fertility and lactation length of crossbred cows and milk yield,

adaptive traits and fertility of indigenous cows in their order of importance. Milk production, fertility, lactation length and adaptation are the most preferred traits farmers would like most to be improved. Therefore, it is concluded that genetic improvement programs would require the use of appropriate breeds and traits taking into account farmers' breed and trait preferences, traditional knowledge and perceptions through participatory planning for sustainable dairy production.

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