

## Evaluation of Crossbred Heifer Calves Rearing Practices and Growth Performace in Urban and Peri-Urban Dairy Systems of Sebeta Awas Wereda, Oromia, Ethiopia

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**Abstract.** The study was aimed at evaluating the rearing practice and growth performance of heifer calves in urban and peri-urban dairy systems of Sebeta Awas Wereda, Oromia National Regional State, Ethiopia. Stratified random sampling method was used to select target farms and sample respondents for the prepared questionnaire. Farms for monitoring study was selected from data collected during the survey. Hence, 18 farms which had crossbred dairy heifer calves of (3-6 months of age), were purposively selected from both production systems and across the entire herd size category. Eighteen heifer calves were monitored from 18 different farms (2 production systems, 3 farm sizes, 3 replicates). Dairy farming has been gradually expanding in the area through years where above 90% of farms were established within last fifteen years. The overall average crossbred dairy herd size per household was  $10.6 \pm 2.1$  in urban and  $11.3 \pm 2$  in peri-urban area, where, the proportion of heifers accounted for 50.5% for urban and 48.8% for peri-urban farms of their respective total herds. Stall-feeding system is commonly practiced in urban and peri-urban farms, mostly feeding hay, straw, high-energy and protein feeds. Above 91.7% households raised their heifer calves through bucket feeding, where, 60%, 26% and 14% of overall farms weaned their calves at three, four and above four months of age respectively. Crude protein (CP) to metabolizable energy (ME) ratio of offered feeds to heifer calves were slightly below the desired level (66:1) in most farms. Body weight change, body condition score, girth height and average daily body weight gain (adg) of heifer calves were not affected by production systems. There was significant difference in body weight changes and adg due to difference in herd sizes. The overall observed heifer calf rearing and growth were good. But relatively inferior performance and prominent management problems were observed in medium sized farms

**Key words:** heifer calf, urban, peri-urban, body weight, body condition score

**Abstrak.** Penelitian ini bertujuan mengevaluasi praktik budidaya dan pertumbuhan sapi heifer di peternakan kota dan pinggir kota di Sebeta Awas Wereda, Oromia National Regional State, Ethiopia. Metode sample acak terstruktur digunakan untuk memilih target peternakan dan sampel responden untuk kuesioner. Peternakan untuk penelitian dipilih dari data yang dikumpulkan selama survei, sehingga ada 18 peternakan dengan sapi heifer perah silang berusia 3-6 bulan dipilih baik dari segi sistem produksi dan dari seluruh kategory jumlah ternak. Delapan belas sapi heifer diteliti dari 18 peternakan berbeda (2 sistem produksi, 3 ukuran peternakan, 3 pengulangan). Peternakan sapi perah berangsur berkembang di daerah itu sepanjang tahun dimana lebih dari 90% peternakan dibangun selama 15 tahun terakhir. Total rata-rata jumlah ternak sapi perah silang per rumah tangg adalah  $10,6 \pm 2,1$  di daerah kota dan  $11,3 \pm 2$  di pinggiran kota, dimana proporsi total ternak heifer sejumlah 50,5% di kota dan 48,85% di pinggiran kota. Sistem stall feeding umumnya diterapkan di peternakan kota dan pinggir kota yang sebagian besar menggunakan pakan jerami, rumput serta pakan tinggi protein dan energi. Lebih dari 97,6% rumah tangga memelihara ternaknya dengan pakan yang diberikan dalam ember, 60% peternakan memelihara ternak berumur 3 bulan, 26% empat bulan dan 14% diatas 4 bulan. Rasio protein kasar (PK) terhadap energi metabolit (ME) pada pakan berada di bawah level peternakan pada umumnya (66:1). Perubahan bobot tubuh, nilai kondisi tubuh, lingkardada dan penambahan bobot tubuh harian (pbbh) sapi heifer tidak dipengaruhi oleh sistem produksi. Ada perbedaan nyata dalam perubahan bobot tubuh dan pbbh karena perbedaan jumlah ternak. Keseluruhan kondisi pemeliharaan dan pertumbuhan sapi heifer bagus, namun peternakan berukuran sedang menunjukkan performa yang kurang baik dan masalah manajemen yang menonjol.

**Kata kunci:** sapi heifer, kota, pinggir kota, bobot tubuh, nilai kondisi tubuh

## Introduction

Sustainability of a dairy production system depends on good herd management. However, lack of dairy replacement heifers is one of the major limitations to the development of smallholder dairy production in developing countries (De Jong, 1996). Formerly, Smallholder farmers sourced dairy replacement stock from public and private large-scale farms at a subsidized price (Tesfaye, 1991). However, rapid expansion of smallholder dairy farms steps forward as large-scale farms rapidly declined (Stotz, 1979; Conelly, 1998). Hence, sourcing of dairy replacements from large-scale farms was becoming very minimal. On the other hand, demand driver factors such as rapidly growing urbanization, high population growth rate, changing consumer preferences are contributing towards the need of expansion of dairy farms in Ethiopia. Since lifetime performances of dairy cows are influenced by the rearing practices at their calf hood, age at which they are weaned, post-weaning management practice and rearing environments (Etgen et al., 1987; Beyene, 1992); evaluation of calf rearing in existing farm is essential as it represents future replacement stock and plays its vital role in dairy farm expansion. Moreover, dairy farms are heterogeneous in terms of resources they own such as land, capital, feed, knowledge of farm owner, objectives of dairy raising, herd number they have, it is inevitable to bring difference in heifer calf rearing and growth performances. Therefore evaluating and understanding of the existing heifer calf rearing practice and growth performance necessitate in the area to devise appropriate development interventions.

## Materials and Method

**Description of The Study Area.** The study was conducted in Sebeta Awas Wereda, particularly in and around Sebeta town, which is located between 24 and 45 km south west of the

capital city, Addis Ababa, in Oromia Region, central Ethiopia. It is situated at latitude 8°55'N 38°37'E and longitude 8.917°N 38.617°E. It has an area of 87,532 hectare.

**Sampling Procedures.** Dairy production systems were stratified in to two based on relative distances from the centre of the town, farm land size and the existence of crossbred cows. These were: urban dairy farms, those farms which are located within the town and peri-urban dairy farms, those farms which are located in the periphery of the town at a distance accessible to the nearby towns. Hence, this study considered those farms located at a distance of 3 km and farther as peri-urban, while farms located within three km radius were considered as urban. Each production system was further stratified into three based on herd size: small holders (farms having  $\leq 3$  cows), medium level (farms having  $>3-10$  cows) and large scale (farms having  $>10$  cows) as suggested by ILRI (1996) and cited by Yoseph (1999). A total of 120 farms, 20 from each herd size of both production systems ( $20 \times 3 = 60$  from urban and  $20 \times 3 = 60$  from peri urban) were selected for survey following stratified random sampling methods. Semi-structured questionnaire was prepared for data collection and pre-tested before commencement of the actual survey (ILCA, 1990). Information was gathered by interviewing the household heads or persons directly responsible for handling of animals and making decisions.

**Sampling for Monitoring.** Selection of monitored farms was based on the survey information. Hence, 15% of the farms, with heifer calves of 3-6 months of age, were selected purposively from both production systems and across the entire herd sizes category. The total number of farms monitored were 18 (3 farms, 3 herd sizes, 2 production systems). A single calf per each farms were monitored for feed intake and growth performance for three months.

**Monitoring Feed Intake.** Type and amount of feed offered and refused by heifer calf was weighed by using a portable spring balance and recorded per farm on weekly bases.

**Monitoring Growth of Calves.** Heart girth and wither height at shoulder measurements of calves were taken in morning before feed was offered, at two weeks interval with the aid of plastic measuring tapes calibrated in cm. Body condition of calves was also scored on a scale of 1-5 (Edmondson et al., 1989) and determined concurrently with the weight estimate of the calves. Body weight of calves was estimated from heart girth measurement using the following formula as suggested by Masanga et al. (2006)  $Y = 1.60X - 81.6$ . Where Y = body weight in kg, X = heart girth in cm.

**Statistical Analysis.** Both quantitative and qualitative data collected during the survey were analyzed using SPSS (2008). Descriptive statistics such as means, percentages, standard deviations, standard error of mean were used to describe the various variables in the production systems. General Linear Model (GLM) procedure of SAS (2008) was used for analyzing those monitored data stratified into production systems and herd size. Mean comparison was done using the Least Significant Difference (LSD) for variables whose F-values showed a significant difference at 5% level of significance. The statistical model used for analysis of growth of heifer calves was:  $Y_{ij} = \mu + d_i + P_j + b(\text{Bwt}_{ij} - \text{Bwt}) + e_{ij}$ . Where  $Y_{ij}$  = response variable;  $\mu$  = overall mean;  $d_i$  = fixed effect of the production system;  $P_j$  = fixed effect of herd size;  $\text{Bwt}_{ij}$  = initial body weight of each calf at three months age;  $\text{Bwt}$  = average body weight of calves;  $b$  = linear regression of initial weight on subsequent weights;  $e_{ij}$  = effect of random error for calf growth.

## Results and Discussion

**Household Characterization.** Among overall respondents 71.7% were male, while 28.3%

were female-headed households Table 1. Male headed-households dominated in peri-urban large sized farms whereas, higher proportion of female-headed households was recorded in small and large sized urban farms. This finding is in agreement with what has been reported for Mekelle, 27% for female-headed (Negussie, 2006) but slightly higher than what has been reported for Addis Abeba (24.1%), (Yoseph et al., 2003), Awassa (23.3%) (Ike, 2002) and Bahir Dar and Gonder (23%) (Yitaye, 2008). This indicates that women involvement in dairy sector play an important role in the study area. The high percent of female-headed households in the present study was due to better access for market to sell milk and encouraging opportunity of credit services from different micro finance institutes.

Educational status of the household heads, about 81.3% households had gone through the formal primary and above primary level of education, while 11.7% of members were limited to informal education which enabled them to read only (Table 1). The result obtained is comparable with what has been reported for Addis Ababa milk shade where 78% of the households were literate (Yoseph et al., 2003) and that of Shashamene-Dila (Sintayehu et al., 2008) where the proportion of illiterate farmers was 19% but greater than what has been reported for Mekelle (73.5% literate) (Negussie, 2006). In the current study, since most of the dairy farm holders are literate, it is easy to address dairy production improvement strategies through good extension and training programs.

**Family Size and Age Distribution.** The average family size per household in urban and peri-urban areas was  $5.9 \pm 2.6$  and  $6.5 \pm 2.9$ , respectively with an overall mean of  $6.2 \pm 2.7$  persons per family (Table 2). Larger family size in peri-urban farms, might be associated with the labour requirement for various farm activities in the areas. Family size observed in

this study is less than the value reported by Ike et al. (2005) for urban and peri-urban dairy farmers in Awassa which was 7.55±2.92 and 8.64±2.70, respectively. Higher result of 7.2±0.3 was reported from urban farms of Shshamene-Dila area(Sintayehu et al., 2008). Result from West Shoa Zone indicated slightly higher family size (7.1±2.0) per household (Deresse, 2008).

The distribution of age along the different age groups varied within the three-farm categories. In both production systems, highest numbers of respondents were found in the age group of 51–65 years and 36–50 years whereas, the lowest number of respondents in the age groups of 66-80 years old. The overall mean age of respondents was 48.8±1.1years with an average age of 49.2±1.7 years in small, 46.2±1.6 years in medium and 52.9±2.6 years in large sampled farms. The smallest mean age of respondents was found in medium farms. As respondents age indicated, most dairy cow owners were adults in their late forties.

Negussie (2006) indicated that the overall mean age of respondents’ in Mekelle was 51.35±1.01 years with an average age of 51.01±1.17 years in small, 51.3±2.38 years in medium and 56 ± 3.19 years in large sampled farms which is slightly greater than the present result. Higher percentage (63.2%) of respondents was reported for the age groups between 25-50 years in Shashamene-Dila areas (Sintayehu et al., 2008). In general, fifty percent of the respondents’ ages were in between 20-50 years old, the other 43% were between 51-65 years old for present study. From the results it can be deduced that most of the respondents were in their productive age’s category.

**Division of Labours.** Most activities of dairying in small sized farms were done by the family members. Majority of large (80.2%) and medium (73.6%) sized farms use hired labour to run their dairy activities Table 3. This figure is comparable to the urban dairying reported for

Table 1. Sex and educational status of households in Sebeta Awas Wereda

Variables	Urban farms			Peri urban farms			Overall N=120
	Small N=24	Medium N=28	Large N=8	Small N=22	Medium N=28	Large N=10	
Gender of household head (%)							
Male	64.7	75	66.7	70.6	71.4	78.6	71.7
Female	35.3	25	33.3	29.4	28.6	21.4	28.3
Educational level of household head (%)							
Illiterate	0	6.3	16.7	5.6	14.3	7.14	8.3
Read and write only	6.3	15.6	16.7	16.7	3.6	14.3	11.7
Primary school level (1 to 6 Grades)	12.5	6.3	8.3	27.8	10.7	7.1	11.7
Junior school level (7 to 8 Grades)	25.0	3.1	0	0	3.6	0	5
Secondary school level	25.0	40.6	33.3	44.4	42.9	28.6	36.7
Certificate and diploma level	18.8	18.8	33.3	0	17.9	14.3	16.7
Degree (Bsc) level and above	12.5	9.4	0	5.6	7.1	28.6	10

N: number of farms

Table 2. Family size and age distribution of interviewed households in Sebeta Awas wereda

Variables	Urban(N=60)	Peri-urban(N=60)	Overall(N=120)
Family size (Mean±SD)	5.9±2.6	6.5±2.9	6.2±2.7
<b>Age distribution (%)</b>			
20-35 years old	13.95	17.65	15
36-50 years old	32.56	41.18	35
51-65 years old	44.19	41.18	43
66-80 years old	6.98	5.88	7

N: number of farms

Mekele town, where the involvement of hired labour goes as high as 75.7% in large and medium-scale farms (Negussie, 2006) but lower results (5 to 11.7%) were reported in Shashamene-Dila area (Sintayehu et al., 2008). Relative to small and medium sized farms, majority of urban and peri-urban large farm activities were done by hired labour. Among the total number of farms considered, 62.5% of dairy farm activities in the study area were done by hired labour. The high percentage involvement of hired labour was probably related to the more frequent engagement of the owners in off-farm activities such as government job, trading (businessmen) and private work, as indicated above.

**Establishment Ages of Dairy Farms.** The overall age of dairy farms indicated that most of the farms were established recently; only 9.8% were established before sixteen years ago. About 83.4% and 73.4% of the urban and peri-urban farms were established over the last 10 years respectively. This revealed that there is an increment in milk production due to the gradual expansion of dairy farms in the urban and peri urban areas. Similarly, Mekonnen et al. (2005) indicated that 51% of smallholder dairy farms near Addis Ababa had less than six years of age. Lower percentage was reported by Sintayehu et al. (2008) for urban dairy farms in Shashamene-Dila area for dairy farms established during the last six years.

**Herd Composition of Crossbred Dairy.** The average herd size owned per household in urban and peri-urban production systems is shown in Table 5. In this study, the overall average herd size of crossbred dairy herds per household was  $10.6 \pm 2.1$  in urban and  $11.3 \pm 2.0$  in peri-urban areas. Slightly lower result was reported in Bahir Dar and Gonder areas where the average herd size per household was 9.2 cows per urban farm (Yitaye, 2008). Lower herd size of  $6.9 \pm 5.8$  and  $4.7 \pm 3.9$  was reported in urban and peri-urban farms of Awassa and

West Shoa zone, respectively (Ike et al., 2005 and Deresse, 2008). Mekonnen et al. (2005) also reported lower herd size of 4 per farm around Addis Ababa.

The proportion of cows in the total herd in the current study is 46.3%. This result is lower than 50% reported for urban and peri-urban dairy farms in Addis Ababa milk shed (Yoseph et al., 2002). The overall proportion of milking cows accounted for 76.7 and 81.2 percent of the total cows in the herd of urban and peri-urban farms, respectively indicating that slightly higher proportion of productive cows were held in both cases. Comparatively less milking cows were kept in West Shoa Zone (Deresse, 2008) that is, 71.8 and 67.5% of the total cows in the herd in urban and peri-urban farms, respectively. Hoffman (1999) reported lower value of 42% lactating and 27% dry cows in urban and peri-urban dairy farms of Addis Ababa. Higher numbers of cows were reported in urban (9.3%) than peri-urban (7.4%) farms that were kept dry and non-pregnant. This suggests the existence of reproductive management problem in the farms, letting an unnecessary extra expense for their feeding and other management aspects which is uneconomical. The less existence of male animals indicated that cattle are predominantly kept for milk production to generate income through sale of milk and milk products. Similarly, Kurtu et al. (2003) reported that larger percentage of dry and non-pregnant cows were recorded in large and specialized farms of the Harar milk shed. Earlier works by Hoffman (1999) reported almost similar value of 9% for dry non-pregnant cows. Comparatively, the current study shows a lower number of dry non-pregnant cows owing to better awareness and improved reproductive management provided to the cows in the study area. The overall proportion of calves in urban farms (50.5%) and peri-urban farms (48.8%) which is in better state for future herd replacement. Moran and Tranter (2004)

reported that farmers should aim to rear 20 to 25% of their milking cows each year as replacements heifer.

**Crossbred Heifer Calf Rearing Practices.** A good heifer rearing program is critical to produce animals at first calving that have well-developed mammary glands capable of producing to the animal's genetic potential and that have good body size and body condition capable of high feed intake and delivery of nutrients to the mammary gland. Since urban and peri-urban dairy production system of Sebeta Awas Wereda was dominated by landless type of production system, the only option for calf rearing was stall feeding. Among the overall interviewed dairy cattle producers, 91.6% of households raised their calves through bucket feeding whereas, few farmers (8.3%) raised their calves through suckling Table 6. Of those calves raised through suckling 25% were from Peri-urban small scale farms. Slightly higher percent (94%) of calves were raised through bucket feeding in Dire Dewa areas (Emebet, 2006).

About 74.3% of dairy farmers in the study area fed their calves with 3-4.5 liters of milk per day while 22.4% fed more than 4.5 liter per day during the first months of calves' life. Lower amount (<3 liter) of milk provision was observed in small urban (22.2%) and peri-urban (33.3%) farms, which might be in search of high milk for market. Likewise, in the second months of calf life, 88.3% of the dairy farmers provide 3-4.5 liter of milk per day, 8.3% more than 4.5 liter and 3.3% less than three litters. However, in the third months of calf life, from those which didn't weaned their calf, 65.6% of overall interviewed household provided less than three liter of milk per day, 30.4% provided 3-4.5 liter of milk/day and 4.07% provided more than 4.5 liter of milk/day. In this study about 95% of dairy cattle producers sold their male calves within 3-15 days of age. Losada et al. (1996) reported that in suburban Mexico city, high

percentage of producers (80%) sell male calves within three days of age for slaughtering, whereas, large dairy farms in China slaughtered bull calves at birth, because of high milk price. Contrarily, 37% of new born male calves were wasted for dog and wild beasts (Kurtu et al., 2003) in Harar region. This study further demonstrated that calves within the age ranges of seven to fifteen days age had a better market opportunity.

**Beginning of Dry Feed Supplementation and Weaning Age of Calves.**

Among the overall interviewed dairy producers 59.9% weaned their calves at three months of age, while the remaining 25.9% and 14.1% weaned at fourth months of age and more than four months of age, respectively Table 7. Majority of the peri-urban large farms weaned their calves early, which was due to the fact that these farms have a chance to let their calves graze and practice early supplementing of roughage feed within 30 days of age and concentrate feed within eight weeks of age. About fifty percent of urban and peri-urban medium (25.9%) sized farm weaned their calves at four months of age, because most of them start supplementing either roughage or concentrate lately. Of the interviewed households, 55.3% urban medium and 100% of peri-urban medium farms start feeding concentrate after six weeks of age. From those farms which provide milk for calves for more than four months, the large sized farms in urban and peri-urban took the highest share (14.1%), these farms started supplementing grass (before-30days) and concentrate (within 6 weeks) early. Prolonged supplementation practice was aimed for better growth and early maturity of heifer calves. In agreement with this study, Matthewman (1993) and Roy (1980) reported that concentrate and hay were introduced and accepted by the calf during the 4<sup>th</sup> week of life for cross bred calf. Previous study indicated that most farms in Sebeta area practiced stall feeding of their calf

and body weight and body condition loss were common in majority of small holders in intra-urban and secondary towns due to shortage of quality roughage and concentrates supplementation (Yoseph, 1999).

**Dry Matter and Nutrient Intake by Heifer Calves.** Feed dry matter and nutrient intake by heifer calves in Sebeta Awas Wereda is shown in Table 8. Dairy heifer should be fed properly in order to be large enough to breed early. Underfeeding and overfeeding have their own side effects on heifer physiological development. Under feeding delays breeding age and age at first calving. Dry matter intake, dietary energy to protein relationship, having an adequate daily gain without fattening are key elements of any good heifer-growing. Dry matter intake (DMI) of heifers progressively increases as heifers grow larger, but their DMI as a percentage of BW progressively decreases from a high of about 3% around weaning to a low of about 1.8% near calving. Along with this change in relative DMI, there is also a suggested change in the ratio of dietary protein to energy in grams of crude protein/M cal of metabolizable energy/kg of DM (Vande Haar, 1998 as cited in NRC, 1989). For the first 6 months of age, this ratio is recommended to be 66, declines to 63 for months 8 to 12, declines further to 60 for months 12 to 16, bottoms out at 56 for months 14 to 23, and then increases to 60 for months 23 to calving at 24 months of age (NRC, 1989). On the other hand, there is a need to grow heifers without fattening. Hence, an average daily body weight gain (ADG) of 0.68 to 0.77 kg during the first two months of a calf's life results in a doubling of body weight (BW) by 2 months of age. An ADG of 0.82 to 0.91 kg during the subsequent 22 months results in a BW of 636 kg at 22-24 months of age. This is a reasonable pattern of growth for heifers to first calve at 24 months of age. But an ADG of 1.14 to 1.36 kg based on the maximum rate of protein deposition being about 1 kg/day

(Meyer, 2007 as cited in NRC, 1989) growth rates greater than that would be fattening. This overfeeding leads to the accumulation of fatty tissue at the expense of secretory tissue in the developing udder. Where, excessive growth before puberty may limit formation of milk secretory tissue which may permanently impair the milk producing ability of the heifer.

Present study result showed that, the ratio of CP to ME in urban medium and peri-urban large was lower than the desired level (66:1), which might contribute to prolonging the age at which heifer reach puberty. On the other hand, the result for urban small and large sized farms peri-urban medium farms was in better feeding status according to the CP to ME ratio recommendation made by NRC (1989). Regarding CP to ME ratio in diet, analysis of variance showed non-significant difference ( $P>0.05$ ) between the production systems and the different farm scales.

**Body Weight Changes of Heifer Calves.** Body weight of growing heifers and relationships to mature body weight are management targets to consider for poverty, breeding, first calving age and subsequent lactation. puberty begins at 50-55% of mature body weight, this occurs at about 317 kg for large breeds and 227-272 kg for smaller breeds and when heifer reach 60-65% of their mature body weight they are usually bred after exhibiting three to five estrus cycle (Hoffman, 2003). Heifers within breed should reach 85% of mature body weight after their first calving, 92% after their second calving 96% after their third calving (Van Amburgh, 2005). The overall least square mean estimated body weight of present study indicates a linear increment as the age of heifer calves advanced in urban and peri-urban farms Table 9. This implies that the level of management might be good in these farms. Body weight change, body condition score and girth height at shoulder of calves were not affected ( $P>0.05$ ) by production

Table 3. Labour division in urban and peri-urban dairy farms of Sebeta Awas wereda (N=120)

Farm activities	Urban			Peri-urban			Overall
	Small	Medium	Large	Small	Medium	Large	
Feeding, herding and Selling milk (%)							
By family	48.6	33.9	26.7	75	28	12.5	37.5
By hired labour	51.4	66.1	73.3	25	72	87.5	62.6
Selling cows (%)							
Owner	100	100	85.3	100	100	85.3	95.2
Manager	0	0	14.3	0	0	14.3	4.8

Table 4. Establishment ages of urban and peri-urban dairy farms in Sebeta AwasWereda

Farm age (%)	Urban (%)	Peri-urban (%)	Overall (%)
	N=60	N=60	N=120
1-10 years	83.4	73.7	80.3
11-15years	7.1	15.8	9.8
>16 years	9.5	10.5	9.8

N: number of interviewed households

Table 5. Number, percent and Mean $\pm$ SE of means of crossbred herd composition of urban and peri-urban dairy farm of Sebeta Awas Wereda

Variables	Urban				Peri-urban			
	Small	Medium	Large	urb.- Total	Small	Medium	Large	peri-urb total
	N=24	N=28	N=8	N=60	N=23	N=27	N=10	N=60
Milking cows	n	n	n	n (%)	n	n	n	n (%)
Pregnant	10	40	29	79(33.5)	17	45	61	123(35.)
Non-pregnant	20	44	38	102(43.2)	14	56	91	161(46)
Dry cows								
Pregnant	9	16	8	33(14)	5	22	13	40(11.4)
Non-pregnant	1	14	7	22(9.3)	2	11	13	26(7.4)
Total cows	40	114	85	236(44.8)	38	134	178	350(47.4)
Heifer (2-3 years age)								
Pregnant	10	30	21	61	5	18	41	64
Non-pregnant	1	29	16	46	3	19	34	56
Heifer(1-2 years age)								
All non -pregnant	11	38	19	68	5	30	79	114
Heifer(1-12months age)				91				
1-3months age	1	11	15	27	4	14	26	44
3-6months age	5	22	13	40	6	10	21	37
6-12 months age	2	16	6	24	6	13	27	46
Total heifers	30	146	90	266(50.5)	29	104	228	361(48.8)
Male calves	1	12	12	25(4.7)	1	16	11	28
Overall Total herds	71	272	184	527	68	254	417	739
Overall(Mean $\pm$ SE)				10.6 $\pm$ 2.1				11.3 $\pm$ 2.0

N: number of respondents'; n: number of herds in farms, SE: standard error

system. However there was significant difference ( $P < 0.05$ ) in body weight due to difference in herd size. Thus, better growth performance was attained in small and large herd sizes than in the medium ones, which was probably due to the fact that in small farms a single or at most two heifer calves were raised

at once which favors them to receive better management, on the other hand, in large farm there was well constructed separate heifer calves pens though, they were managed in group, they received better feeding. Gojjam et al. (2010) indicated that heifers fed a ration with 50% concentrate and 50% roughage had

Table 6. Calf milk feeding practices in urban and peri-urban farms in Sebeta Awas Wereda

Variables	Urban farms			Peri-urban farms			Overall N=120
	Small N=24	Medium N=28	Large N=8	Small N=23	Medium N=27	Large N=10	
<b>Milk feeding systems (%)</b>							
Suckling	7.7	4.2	16.7	25	0	18.2	8.3
Bucket feeding	92.3	95.8	83.3	75	100	81.8	91.7
<b>Amount of milk offered (%)</b>							
1 <sup>st</sup> month 1-3 liter/day	22.2	12.8	0	33.3	0	18.2	14.4
3-4.5 liter /day	77.8	61.7	83.3	66.7	75	81.8	74.4
> 4.5 liter /day	0	25.5	16.7	0	25	0	22.4
2 <sup>nd</sup> month 1-3 liter/day	15.4	4.3	0	0	0	0	3.3
3-4.5 liter/day	84.6	87.2	83.3	100	75	100	88.3
> 4.5 liter/day	0	8.5	16.7	0	25	0	8.4
3 <sup>rd</sup> month 1-3 liter/day	61.5	68.9	80	100	37.5	45.4	65.6
3-4.5 liter/day	38.5	26.7	0	0	62.5	54.6	30.3
> 4.5 liter/day	0	4.4	20	0	0	0	4.1
<b>Male calves (%)</b>							
Culled	100	95.5	100	75	100	81.8	95
Grown for bull	0	4.5	0	25	0	18.2	5

N: number farm household interviewed

Table 7. Beginning of dry feed supplementation and weaning age of calves.

Variables	Urban farms			Peri-urban farms			Overall N=120
	Small N=24	Medium N=28	Large N=8	Small N=23	Medium N=27	Large N=10	
<b>Weaning age calf (%)</b>							
Three months	46.1	68.9	50	50	62.5	81.8	59.9
Four months	46.1	22.2	12.5	50	25	0	25.9
>Four months	7.7	8.9	37.5	0	12.5	18.2	14.1
<b>Roughage suppl.(%)</b>							
7- 15 days	23.1	38	12.5	0	25	22.2	20.1
15-30 days	46.2	40	50	75	50	77.8	56.5
>30 days	30.8	22	37.5	25	25	0	23.4
<b>Concentrate suppl.(%)</b>							
15 -45 days	7.7	44.7	50	0	0	36.4	23.1
46-75 days	53.8	42.6	12.5	100	100	45.5	59.0
>75 days	38.5	12.8	37.5	0	100	18.2	34.5

N: number of farms

Table 8. Feed DM and nutrient intakes (Mean±SE) of calves in urban and peri-urban farms.

Herd size (N=6)	Urban				peri-urban			Ratio
	DM (kg/day)	ME (MJ/day)	CP (g/day)	CP:ME (g/MJ)	DM (kg/day)	ME (MJ/day)	CP (g/day)	CP:ME (g/MJ)
Small	3.1±0.2	31.2±6.4	485.3±137.8	65.3	3.7±0.9	40.9±10.7	589.3±113.2	60.4
Medium	2.7±0.5	28.0±4.6	337.7±44.1	56.6	3.3±0.9	35.8±4.1	545.5±95.7	63.9
Large	3.4±0.7	36.8±7.8	565.8±148.4	64.6	3.4±1.0	36.5±8.9	477.5±163.4	54.9

DM: Dry matter, CP: Crude protein, ME: Metabolizable Energy; MJ: Mega joule SE: standard error; g: gram; the ratio obtained must be multiplied by 4.2 because 1 calorie = 4.2 joule.

higher ( $P < 0.05$ ) daily body weight gain (0.532 kg) and attained puberty at 221 kg (65% of the mature body weight) in 15 months, while heifers fed a diet with 30% concentrate and

70% roughage gained 0.434 kg/day and reached puberty at 247 kg (70% of the mature body weight), about 3 months later. Abdelgadir et al. (2010) reported that heart girth was

significantly ( $P<0.01$ ) affected by the plane of nutrition on which the heifers were reared; Heifers fed on high level of concentrate reached puberty at a significantly ( $P<0.05$ ) younger age and heavier live weight than those fed on low level of concentrate. However, heifers in group did not reached puberty during days on test. The present weight falls in the range of 65-130 kg set by NRC (1989) but below girth height at shoulder (86.61cm-103.63cm) of heifer calves of two to six months of age. Relatively lesser weight was reported by Addisu et al. (2010) for crossbred calf of Fogera crossed Holstein Friesian attaining 92.7 kg at their six months of age.

The present study weight is lower than what has been reported for on farm managed calves by Sendros et al. (1987) but in agreement with on-station data. Friesian crossbred calves consistently grew better at on farm than on station. That is on farm average weights at three months of age was 89 kg and at six months it has 165 kg, while heifer calves at on station had 73 and 114 kg at three and six months respectively. The same author deduced that better on-farm performance was achieved probably because calves grazed on improved

pasture throughout the dry season as opposed to on-station calves' which were kept on natural pasture. MaiVan Sanh et al. (1997) also reported comparable result of crossbred calves reared under restricted suckling attaining 109 kg at their six months of age, whereas Lyimo et al. (2004) reported slightly lower weight attainment of 95.6 kg at six months of age

The average daily body weight gain of heifer calves statistically was not significantly ( $P>0.05$ ) different between production system but the numerical figure indicated by far greater average daily body weight gain in urban farms than peri-urban farms. However there was a significant ( $P<0.05$ ) difference in average daily body weight gains due to difference in herd sizes, hence those calves in large sized farms were superior in average body weight gain than those in medium herd sized and small one. Present study average daily body weight gain is within the range that was recommended by Rosete and Zamora (1985) as cited by Ugarte (1997) which was between 300 to 600 g/day but less than that reported by Sendros et al. (1987). Similar results were reported for crossbred calves from Andasa research center where, the overall mean daily body weight gain of calves from birth to one month, three months, six months, of age were 591, 374, 321, grams respectively (Addisu et al., 2010).

Table 9. LSM ( $\pm$ SE) of body weights of crossbred heifer calves of Holstein Friesian after weaning (three to six months of age).

Parameters	Weight in (kg)									
	Adj.Initial weight		Final weight		ADG (g)		Wither height		BCS	
	N	LSM $\pm$ SE	N	LSM $\pm$ SE	N	LSM $\pm$ SE	N	LSM $\pm$ SE	N	LSM $\pm$ SE
Overall	18	74.93 $\pm$ 5	18	108.6 $\pm$ 3.8	18	374.3 $\pm$ 100.2	18	75.9 $\pm$ 0.9	18	2.84 $\pm$ 0.0
Production system		NS		NS		NS		NS		NS
Urban	9	89.4 $\pm$ 9	9	113.48 $\pm$ 4.7	9	482.6 $\pm$ 165.1	9	75.61 $\pm$ 1.4	9	2.83 $\pm$ 0.1
Peri-urban	9	77.7 $\pm$ 3.4	9	103.8 $\pm$ 4.9	9	266.1 $\pm$ 105.9	9	75.93 $\pm$ 1.2	9	2.91 $\pm$ 0.1
Herd size		NS		*		*		*		NS
Small	6	82.8 $\pm$ 0.2	6	105.2 $\pm$ 2.5 <sup>ab</sup>	6	356.8 $\pm$ 129.1 <sup>ab</sup>	6	77.28 $\pm$ 1.5 <sup>a</sup>	6	2.89 $\pm$ 0.1
Medium	6	74.7 $\pm$ 3.4	6	102.8 $\pm$ 7 <sup>b</sup>	6	149.8 $\pm$ 45.6 <sup>b</sup>	6	73.28 $\pm$ 1.9 <sup>b</sup>	6	2.89 $\pm$ 0.1
Large	6	93.3 $\pm$ 14	6	117.9 $\pm$ 5 <sup>a</sup>	6	616.3 $\pm$ 150.7 <sup>a</sup>	6	76.75 $\pm$ 1.4 <sup>a</sup>	6	2.83 $\pm$ 0.1

Adj.: adjusted, Means in the same column with different subscript letters were significantly different; \*:  $P<0.05$ ; NS: Non-Significant; LSM: Least Square Mean. SE: Standard Error, ADG : average daily body weight gain; N : number of calf monitored in eighteen farms. BCS : body condition score.

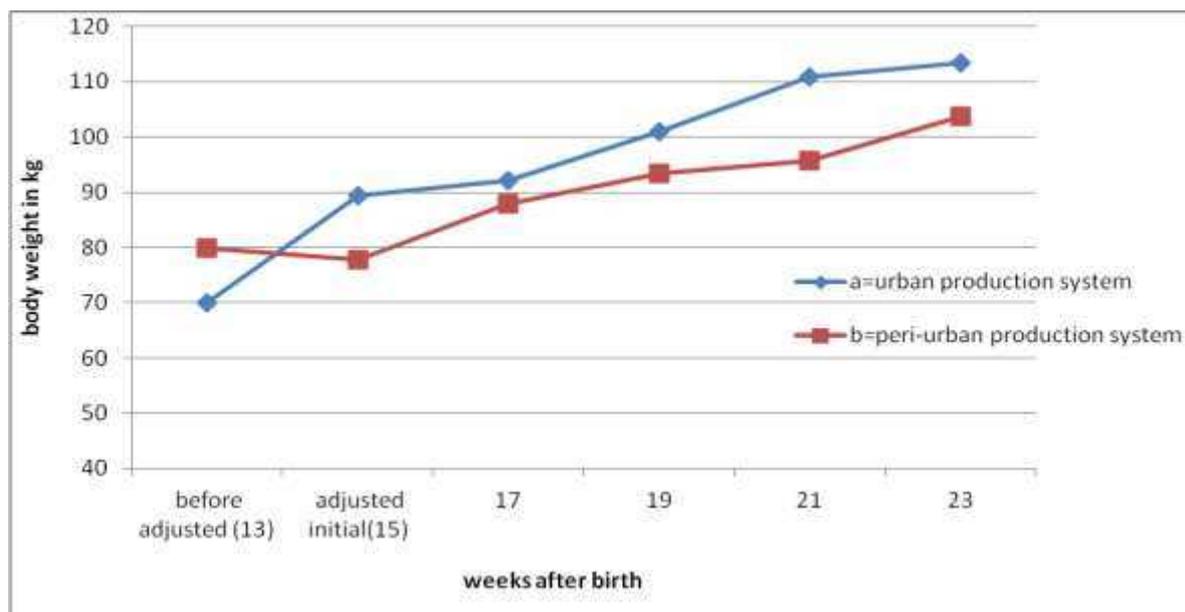


Figure 1. Body weight changes in kg of heifer calves with advance age after birth.

## Conclusion

The overall observed heifer calf rearing and growth were good. But relatively inferior performance and prominent management problems were observed in medium sized farms

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