Global Journal of Science Frontier Research: D
Agriculture and Veterinary
Volume 16 Issue 3 Version 1.0 Year 2016
Type : Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals Inc. (USA)
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

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

By Dereje Shibru, Yoseph Mekasha & Getahun Asebe

Gambella University, Ethiopia

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. Eighteen 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). The overall average crossbred dairy herd size per household was 10.6±2.1 in urban and 11.3±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.

Keywords: *heifer calf, urban, peri-urban, body weight, body condition score.*

GJSFR-D Classification : *FOR Code: 070399*

Strictly as per the compliance and regulations of :

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

Dereje Shibru [α], Yoseph Mekasha [σ] & Getahun Asebe [ρ]

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. Eighteen 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). The overall average crossbred dairy herd size per household was 10.6±2.1 in urban and 11.3±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 (P>0.05) by production systems. There was significant difference (P<0.05) in body weight changes and adg due to difference in herd sizes. The overall observed heifer calf rearing and growth were good. However, relatively inferior performance and prominent management problems were observed in medium sized farms.

Keywords: heifer calf, urban, peri-urban, body weight, body condition score.

I. 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.

II. Materials and Method

a) 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 southwest of the capital city, Addis Ababa, in Oromia Region, central Ethiopia. It is situated at latitude 8°55′N-8.917°N and longitude 38°37′E -38.617°E. It has a total area of 87,532 hectare.

b) Sampling procedures

Dairy production systems were stratified in to two based on relative distances from the centre of the town, farmland size and the existence of crossbred cows. These were urban dairy farms, those farms that are located within the town and peri-urban dairy farms,

Author α ρ: Gambella University College of Agriculture and Natural Resource Department of Animals Science P. o. Box 126 Gambella, Ethiopia. e-mails: shibirud@yahoo.com, getahunasebe@gmail.com
Author σ: Haramay University, P.O. Box 138 Dire Dawa, Ethiopia.

those farms that 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 ≤3cows), medium level (farms having >3-10 cows) and large scale (farms having>10 cows) as suggested by ILRI (1996) and cited by Yoseph (1999). One hundred twenty farms, 20 from each herd size of both production systems (20*3=60 from urban and 20*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.

c) 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.

d) 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.

e) 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

f) 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:

$Y_{ij} = \mu + di + P_j + b(Bwt_{ij} - Bwt) + e_{ij}$

Y_{ij} = Response variable

μ = Overall mean

di = Fixed effect of the production system

P_j= Fixed effect of herd size.

Bwt_{ij}= initial body weight of each calf at three months age

Bwt = average body weight of calves

b = Linear regression of initial weight on subsequent weights.

e_{ij} = effect of random error for calf growth.

III. Results and Discussion

a) 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 in 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.

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

Variables	Urban farms			Peri urban farms			
	Small N=24	Medium N=28	Large N=8	Small N=22	Medium N=28	Large N=10	Overall N=120
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

b) Family size and age distribution

The average family size per household in urban and peri-urban areas was 5.9±2.6 and 6.5± 2.9, respectively with an overall mean of 6.2±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 Shashemene-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.

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
Age distribution (%)			
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

c) 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 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.

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

N=Number of farms

d) 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 increment of milk demand in the area that is alarmed with expansion people 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. Sintayehu et al. (2008) reported lower percentage for urban dairy farms in Shashamene-Dila area for dairy farms established during the last six years.

Table 4 : Establishment ages of urban and peri-urban dairy farms in Sebeta Awas Wereda

Farm age (%)	Urban (%) N=60	Peri-urban (%) N=60	Overall (%) 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

e) 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±2.1 in urban and 11.3±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 ±5.8 and 4.7± 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.

Table 5 : Number, percent and Mean±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
No of respondents	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±SE)				**10.6±2.1**				**11.3±2.0**

N= Number of respondents'; n=number of herds in farms.SE= standard error

f) 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 (<3liter) 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 3-4.5liter 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.

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

Variables	Urban farms			Peri-urban farms			Overall
	Small N=24	Medium N=28	Large N=8	Small N=23	Medium N=27	Large N=10	N=120
Milk feeding systems (%)							
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
Amount of milk offered (%)							
1st 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
2nd 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
3rd month1-3 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
Male calves (%)							
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

g) 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-30 days) 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 4th 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).

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

Variables	Urban farms			Peri-urban farms			Overall
	Small N=24	Medium N=28	Large N=8	Small N=23	Medium N=27	Large N=10	N=120
Weaning age calf (%)							
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
Roughage suppl.(%)							
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
Concentrate suppl.(%)							
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.

h) 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 .82 to .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 per 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 secretary tissue in the developing udder. Where, excessive growth before puberty may limit formation of milk secretary 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.

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

Herd size	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 (N=6)	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(N=6)	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(N=6)	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 1calore=4.2 joule.

i) 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 317kg 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 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 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 65-130kg 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.* (2008) 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 89kg and at six months it has 165kg, while heifer calves at on station had 73 and 114kg 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 300gm to 600gm per 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 (±SE) of body weights of crossbred heifer calves of Holstein Friesian after weaning (three to six months of age)

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

IV. Acknowledgement

The authors would like to pass their deep acknowledge Ethiopian Ministry of Agriculture, Federal ATVET for financial support of this research work.

References Références Referencias

1. Abdelgadir, A. M., Izeldin A. Babiker and Ali. E. Eltayeb, 2010. Effect of concentrate supplementation on growth and sexual development of dairy stall-fed Heifers. Faculty of Agriculture, department of Animal Production, University of Zalingei, Sudan Journal of Applied Sciences Research, 6(3): 212-217, 2010.
2. Addisu, B., Mengistie T., Adebabay K., Getinet M., Asaminew T., Tezera M. and Gebeyehu G. 2010: Milk yield and calf growth performance of cattle under partial suckling system at Andassa Livestock Research Centre, North West Ethiopia. *Livestock Research for Rural Development. Volume 22, Article #136.*Retrieved April 13, 2008, from http://www.lrrd.org/lrrd22/8/bite22136.htm.

3. Conelly, W. T., 1998. Colonial Era Livestock Development Policy: introduction of improved dairy cattle in high potential farming areas of Kenya. World Development 26: 1733-1748
4. De Jong, R., 1996. Dairy stock development and milk production with smallholders. PhD Thesis, Department of Animal Production Systems, Wageningen Agricultural University. The Netherlands 303 pp.
5. Derese, T., 2008. Present situation of urban and peri-urban milk production and quality of raw milk produced in west Shoa zone, Oromia region, Ethiopia.M.sc. Thesis H.U.
6. Edmonson, A. J., J. S. Lean, L. D. Weaver, T. Farver, and G. Webster, 1989. A body condition scorings chart for Holstein Dairy cows. J. Dairy Sci. 72: 68-78.
7. Emebet Moreda,2006. Reproductive Performance of dairy cows under urban dairy production systems in Dire-Dewa. M.Sc. Thesis. HU.
8. Gojjam Y., Yilma Z., Bekele G., Gebre-Wold A. and Demeke S., 2010 Milk production level and calf rearing system affecting Boran, Ethiopian zebu cattle breed, cow-calf performance. Dairy Technology, Ethiopian Agricultural Research Organization, Holetta Agricultural Research Center, P.O. Box 31, Holetta, Ethiopia
9. Hoffman, A., 1999. Cross site and cross location on farm investigation on the reproductive status and reproductive disorder of dairy cows in market oriented urban or peri-urban production system in Addis Ababa region Ethiopia. Diplomma, Thesis post graduate diploma courses animal health management 1998-19999, January 1990, Berlin.
10. Ike, A., 2002. Urban dairying in Awassa, Ethiopia. MSc thesis, University of Hohenheim, Stuttgart-Hohenheim, Germany. 113 pp.
11. ILRI (International Livestock Research Institute). 1996. Annual Report. ILRI, Addis Ababa.
12. Losada H, Grande D, Vieyra J, Arias L, Pealing R, Rangel J and Fierro A 1996c A suburban agro-ecosystem of nopal -production based on the intensive use of dairy cattle manure in the southeast hills of Mexico City. Livestock Reseach for Rural Development. Volume 8, Number 4:66-70.
13. Lyimo C., R .Nukya, L. Schoolman and F.J. Van Eerdenbutg, 2004. Post-partum reproductive performance of crossbred dairy cattle on smallholder farms in sub humid coastal Tanzania. Tropical Animal Health and Production 36: 269-279
14. Mai V. S., T.R. Preston and L. LeViet, 1997. Effects of restricted suckling versus artificial rearing on performance and fertility of crossbreed F1 (Holstein Friesian x Local) cows and calves in Vietnam. Livestock Research for Rural Development (9) 4: http://www.cipav.org.co/lrrd/lrrd9/4/sahn941.htm.
15. Mekonnen, H. M., Assamnew K. and J. F. Courreau, 2005. Husbandary practices and health in small holder dairy farms near Addis Ababa, Ethiopia. Faculty of Veterinary Medicine, Addis Ababa University Debrezeit, Ethiopia.
16. Moran, J and B. Tranter, 2004. Reproductive management of small holder farmers in Veitnam.
17. Negussie G., 2006. Characterization and evaluation of urban dairy production system in Mekelle city, Tigray region, Ethiopia. MSc thesis, Hawassa University, Awassa, Ethiopia.
18. SAS (Statistical Analysis System), 2008. SAS User's Guide, Statistics, Statistical Analysis System (SAS) Institute, Inc.cary, NC. Science. Uppsala, Sweden.
19. Sendros, D. and Tesfayfaye,k.1998.factors to be considered in formulation of livestock breeding policy.In proceeding of fifth national conference of Ethiopian society of animal production(ESAP),15-17,may1997Addis Ababa Ethiopia.
20. Sintayehu Y., Fekadu B., Azage T. and Berhanu G., 2008. Dairy production, processing and marketing systems of Shashemene–Dilla area, South Ethiopia. IPMS (Improving Productivity and Market Success) of Ethiopian Farmers Project Working Paper 9, ILRI (International Livestock Research Institute), Nairobi, Kenya. 62 pp.
21. Stotz. D., 1979. Smallholder dairy development in past, present and future in Kenya. PhD Thesis, Hohenheim University, Germany.
22. Tesfaye Kumsa. 1991. Livestock system of the western region of Ethiopia. IAR Research Report 12. JAR, Addis Ababa
23. Ugarte, J. and T.R. Preston, 1972. Rearing dairy calves by restricted suckling once or twice daily on milk production and calf growth. *Cuban Journal Agricultural Science* 6: 173-182.
24. Ugartee,J. 1997. Heifer rearing in the tropics. Animal production health, FAO. paper 86.
25. Yitaye, A., 2008. Characterization and analysis of urban and peri-urban dairy system in the northern western Ethiopia highland. PHD thesis submitted to Boku University of natural resource and applied life science. Veinna, Austria
26. Yoseph Mekasha, 1999. Impact of feed resources on productive and reproductive performance of dairy cows in the urban and peri-urban dairy production system in the Addis Ababa milk shed and evaluation of non conventional feed resources using sheep. An MSc Thesis presented to the School of Graduate Studies of Alemaya University.
27. Yousuf Kurtu, M., 2003. Certain aspects of the dairy systems in the Harar milkshed, Eastern Ethiopia, (unpublished PhD thesis, University of the Free State Bloemfontein).

This page is intentionally left blank