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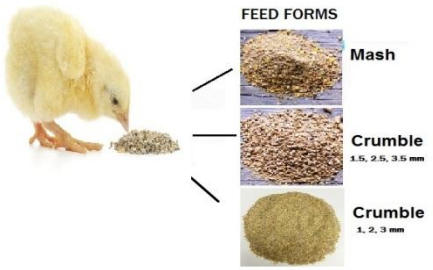
## Volume 7 (2); 25 March 2017




**Research Paper**

### Influence of different feed forms and particle size on efficiency of broiler production.

Nabi F, Ismail Rind M, Li J, Zulqarnain M, Shahzad M, Ahmed N, Kashif Iqbal M and Rehman MU.

*Online J. Anim. Feed Res.,* 7(2): 24-28, 2017; pii: S222877011700005-

**Abstract**

The influence of different feed forms and particle size on feed and water intake, live body, carcass weight, internal organs weight and the performance in broiler chicks was examined. A total one hundred and fifty chicks were distributed into groups A, B and C. Group A was served with mash feed, and group B and C were fed with crumble feed of 1, 2 and 3 mm and 1.5, 2.5 and 3.5 mm particle size each at a pre-starter, starter and finisher phases, respectively. Result show that feed forms had significant influence on the growth of broilers. Feed and water intake also live body weight in crumble fed group C were higher ($P < 0.05$) than group B and A. Alongside carcass weight in group C was also higher than group B and A. The broiler liver, heart, gizzard and intestine weight found higher in group C than group B and A significantly ($P < 0.01$). In conclusion, the crumble feed form showed improvement of growth in broiler chicken. The crumble feed form of 1.5, 2.5 and 3.5 mm particle size at pre-starter, starter and finisher ration may be preferred for higher production and feed conversion ratio in broiler chicken.

**Keywords:** Broiler, Crumble, Feed form, Mash, Pellet, Production

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**Research Paper**

### Cattle selection criteria and fattening practices in urban and peri-urban Kebeles of Dessie and Kombolcha Towns, Ethiopia.

Ahmed K, Tamir B, Mengistu A.

*Online J. Anim. Feed Res.,* 7(2): 29-37, 2017; pii: S222877011700006-7

Abstract

The aim of this research was to investigate cattle selection criteria and fattening practices in urban and peri-urban kebeles of Dessie and Kombolcha towns, Ethiopia. In this study, structured questionnaire was administered to a total of 337 cattle fattener households. Complete enumeration techniques were applied to select urban and peri-urban kebeles. The results indicated culturally cattle fattening management activities were left to males and age, castration condition, sex, breed/type, farming condition and growth stage were the identified cattle selection criteria for fattening in both towns. As per group discussion, in both study towns peri-urban cattle fatteners were practiced cattle fattening in dry and wet season whereas urban cattle fatteners only practiced in dry season. In both study towns peri-urban cattle fatteners (100%) were dominantly fatten cattle once per year and on average one fattening duration take three, four and five months based on 24.8%, 52.3%, 22.8% and 33.3%, 28.4%, 38.3% households response, respectively. 100% of urban cattle fatteners were dominantly fattened cattle twice per year and on average one fattening duration has taken two months, and two and half months based on 75.6% and 24.4% of urban fatteners response in Dessie town, respectively; whereas, 62.1% and 37.9% of urban fatteners in Kombolcha town reported two, two and half and three months of duration, respectively. Therefore, to boost up the newly emerging urban as well as peri-urban cattle fattening sector scientific intervention should be initiated for further improvement in fattening practices based on the generated information.

**Keywords:** Cattle, Fattening system, Peri-urban, Urban

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**Research Paper**

### Effect of graded levels of browse forage (*Balanites aegyptiaca*) leaves inclusion in the diets of growing rabbits.

Andrew John A, Nasiru A, Dauda A and Yakubu Nenrotmwa R.

*Online J. Anim. Feed Res.,* 7(2): 38-42, 2017; pii: S222877011700007-7

Abstract

Thirty mixed sex cross breeds (*chinchilla x California x New Zealand*) weaner rabbits aged 4 weeks old were used to evaluate the effect of graded levels of browse forage (*Balanites aegyptiaca*) leaves inclusion in the diets of growing rabbits on growth performance and nutrient digestibility of weaner rabbits. Five diets were formulated, treatment 1(control), 2 3 4 and 5 in which Groundnut haulm was replaced with *Balanites aegyptiaca* at 0%, 5%, 10%, 15%, and 20% respectively. The rabbits were allotted to the five treatments (T1, T2, T3, T4, and T5) with two rabbits per replicate and six rabbits per treatment in a randomized complete block design. The rabbits were fed with the experimental diets and clean drinking water *ad libitum* for experimental period of eight weeks (56 days). All the parameters under observation showed significant ($P < 0.05$) difference among the treatment groups. In conclusion *Balanites aegyptiaca* leave meal can replace groundnut haulm without adverse effect on the rabbits.

**Keywords:** Rabbit, Balanite aegyptiaca and Groundnut Haulm

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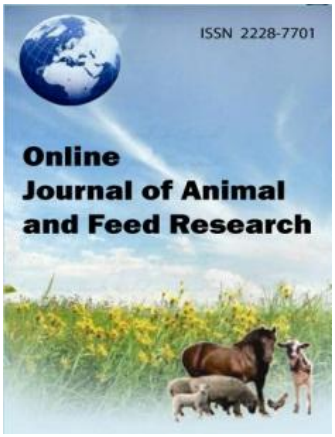


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# INFLUENCE OF DIFFERENT FEED FORMS AND PARTICLE SIZE ON EFFICIENCY OF BROILER PRODUCTION

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**ABSTRACT**: The influence of different feed forms and particle size on feed and water intake, live body, carcass weight, internal organs weight and the performance in broiler chicks was examined. A total one hundred and fifty chicks were distributed into groups A, B and C. Group A was served with mash feed, and group B and C were fed with crumble feed of 1, 2 and 3 mm and 1.5, 2.5 and 3.5 mm particle size each at a pre-starter, starter and finisher phases, respectively. Result show that feed forms had significant influence on the growth of broilers. Feed and water intake also live body weight in crumble fed group C were higher ($P<0.05$) than group B and A. Alongside carcass weight in group C was also higher than group B and A. The broiler liver, heart, gizzard and intestine weight found higher in group C than group B and A significantly ($P<0.01$). In conclusion, the crumble feed form showed improvement of growth in broiler chicken. The crumble feed form of 1.5, 2.5 and 3.5 mm particle size at pre-starter, starter and finisher ration may be preferred for higher production and feed conversion ratio in broiler chicken.

**Keywords:** Broiler, Crumble, Feed form, Mash, Pellet, Production

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## INTRODUCTION

The feed cost is estimated at 60-70 percent of total production costs in broiler farming. The feed processing contributes a significant portion of feed cost (Nolan et al., 2010). Beyond the nutritional adequacy the physical form of feed are important factor in yielding meat of broiler (Behnke and Beyer, 2004). Feeding a pelleted diet improves animal performance and feed conversion ratio as compared with feeding a meal form of a diet, pellet attributed to decreases feed wastage, selective feeding, ingredient segregation also less time and energy expended for feed prehension, destruction of pathogenic organisms and improved palatability (Behnke, 1994). Various strategies can be employed to satisfactory feed particle adhesion, nutrient availability as well manufactured high physical quality pellets; yet, challenges remain in the employment of such schemes (Moritz and Lilly, 2010).

The feed intake of broiler chicken has been reported to be ten percent more than in crumble feed form as compared with mash. Crumble is a type of feed form prepared at the feed mills through crushing the pelleted feeds forms to a consistency coarser than mash feed (Mirghelenj and Golian, 2009). Mash form gives a better unification of growth, less loss and more economical. The ground feed is not much palatable and does not retain their nutritive value as well as ungrounded feed (Jahan et al., 2006). Generally as compared to mash feed form the feeding of pellets feed forms improves broiler growth rate with an increased feed intake (Nir et al., 1994).

Pellet can improve the early growth rate and performance of broiler production as extending the feeding period. Mash or crumble feed followed by pellets has been resulted in similar growth performance in later stage of the age periods (Cerrate et al., 2008). Current study was planned to the influence of different physical feed forms and particle size on broiler performance, feed and water intake, live body and carcass weight, and weight of internal organs in broiler chicks was examined moreover, beneficial effects in different phases of broiler production.



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## MATERIALS AND METHODS

### Chick sexing

All the experiments were conducted in accordance with the Sindh Agricultural University Tandojam Animal health care committee guidelines. 1 Day-old Hubbard male broilers (n=150) were obtained from commercial hatchery. Immediately, after arrival of chicks at the research station sexing was performed by feather sexing method, from the primary and secondary feathers located on the chick's wings. The broiler chicks were initially weighed, and equally divided into three (n=50) groups namely A, B and C. All the chicks were reared up to 42 days on three different feed forms. Standard housing requirements for broiler chicks were allocated.

### Chicks grouping and feed ration

The chicks in group A were fed with mash as control. Group B with crumble feed 1, 2, and 3 mm particle size to pre starter, starter and finisher ration respectively, and Group C was fed with crumble feed 1.5, 2.5 and 3.5 mm particle size to pre starter, starter and finisher ration respectively. Broiler fed in starter diets containing 22% CP, 3000 kcal/Kg/ME and finisher diet 19% CP, and 3200kcal/Kg/ME to all forms of feed. *Ad libitum* standard feed and fresh water were supplied to the birds. Refusal of feed and water was deducted from feed and water offered; finally, the daily water consumption was recorded. Mortality was recorded daily, at the age 4$^{th}$ and 6$^{th}$ week, ten broilers from each group were selected randomly euthanized by cervical dislocation to calculate the weight of carcass and weight of edible and non-edible parts. Based on dressing carcass, dressing percentage was calculated. For assessment of incomes and net returns from the experimental rations in relation to feed forms per bird cost for each group was worked out, and net returns were calculated.

### Statistical Analysis

Assessment between mean values of all the experimental groups were carried out using one way ANOVA followed with student t test and presented as means ± standard error of means (SEM). The differences were considered statistically significant if $P<0.05$.

## RESULTS

### Feed and Water consumption

Effects of different feed forms on broiler feed and water consumption are shown in Table 1. The present findings indicate that the broiler of group C fed crumble feed of 1.5, 2.5 and 3.5 mm particle size consumed more feed and water as compared to group B (crumble feed of 1, 2 and 3 mm particle size) and control group-A, However, the differences were statistically non-significant ($P>0.05$) between groups, but highly significant ($P<0.05$) for weeks (Table 1).

### Live body weight and FCR

Effect of different feed forms on live body weight of broiler was highly significant ($P<0.01$) live body weight was higher in broiler of group C (2248.04 g/b) than group B and A (Table 2). The feed conversion ratio was remarkably superior (1.72) in group C, while being moderate (1.81) in broiler of group B, a relatively poor feed conversion ratio of 1.89 was recorded in broiler of group A fed mash feed.

### Carcass weight and dressing percentage

Average carcass weight and dressing percentage of broiler fed different feed forms at the age of 4$^{th}$ week and 6$^{th}$ week are presented in Tables 3 and 4, respectively. Carcass weight of 815.60 g/b after 4 weeks age with 59.86 dressing percentage was higher in group C broiler significantly ($P<0.01$) than group B and A in both parameters at 4th-week of age, although the broiler fed mash feed produced lowest carcass weight of 557.20 g/b from 1024 g/b live body weight with 54.16 dressing percentages. At the end of the experiment at the age of 6th week the carcass weight was also higher (1366 g/b) with 60.39 dressing percentage in group C broiler than group B broiler (1278 g/b) with 59.33 dressing percentages and group A (1150 g/b) with 57.68 dressing percentages significantly ($P<0.05$).

### Internal organs weight

Internal organs weights of broiler fed different feed forms at the age (4$^{th}$ week), and final periods (6$^{th}$ week) is presented in Tables 03 and 04. The liver, heart, gizzard and intestine weights after 4 weeks of slaughtering were higher significantly ($P<0.05$) in group C broiler i.e. 42.60, 10.80, 38 and 90 g/b than 38, 9.80, 34.60 and 88.60 g/b in group B and lowest weights of 37.60, 7.80, 31.20 and 68.40 g/b in group A broiler was recorded respectively



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(Table 3). Similarly, after six weeks age, the liver, heart, gizzard and intestine weights were higher in group C significantly (P<0.05), i.e. 51.55, 11.02, 39.55 and 127 g/b than 50.78, 10.38, 36.43 and 122.60 g/b in group B and lowest weights of 47.82, 9.61, 34.27 and 117.20 g/b in group A, respectively (Table 4). Statistically, the differences in both periods were significant between groups (P<0.05).The net returns of broiler after selling was beside studied, the broilers in group C generated greater net profit than group B and A with more net return (data not shown).

**Table 1.**

| Age (Week) | A | | B | | C | |
|---|---|---|---|---|---|---|
| | Feed | Water | Feed | Water | Feed | Water |
| 1 | 114.24 | 266.98 | 117.11 | 297.22 | 119.56 | 305.97 |
| 2 | 274.47 | 644.00 | 284.27 | 735.00 | 289.38 | 777.98 |
| 3 | 496.51 | 1727.02 | 526.40 | 1477.98 | 502.95 | 1484.00 |
| 4 | 768.32 | 2167.97 | 776.09 | 2177.00 | 788.69 | 2221.03 |
| 5 | 968.10 | 2536.03 | 997.78 | 2825.97 | 1016.26 | 2814.00 |
| 6 | 1108.24 | 3178.00 | 1112.86 | 3353.98 | 1138.76 | 3566.01 |
| Total | 3729.88 [a] | 10220.00[b] | 3814.51 [a] | 10867.15[b] | 3855.60 [a] | 11168.99 [b] |

Average feed (g/b/week) and water (ml/b/week) consumption of broiler fed different feed particle size and forms (n=50). Means followed by different letters in the rows are significantly different (P<0.05)

**Table 2.**

| Age (Week) | A | B | C |
|---|---|---|---|
| 0 | 37.710 | 38.250 | 38.970 |
| 1 | 135.30 | 153.83 | 164.14 |
| 2 | 285.26 | 351.56 | 369.58 |
| 3 | 600.12 | 725.68 | 766.86 |
| 4 | 1128.42 | 1288.3 | 1345.5 |
| 5 | 1624.02 | 1751.2 | 1785.6 |
| 6 | 1977.54 [c] | 2110.66 [b] | 2248.04 [a] |

Average live body weight of broiler fed different feed forms (g/b/week). [abc] Means followed by different letters. [abc] in the rows is significantly different (P<0.05)

**Table 3.**

| Groups | Live weight | Carcass | Dressing % | Liver | Heart | Gizzard | Intestine |
|---|---|---|---|---|---|---|---|
| A | 1024 [b] | 557.20 [b] | 54.16 [b] | 37.60 [b] | 7.80 [a] | 31.20 [b] | 68.40 [a] |
| B | 1346 [a] | 789.20 [a] | 58.63 [a] | 38.0 [ab] | 9.80 [a] | 34.60 [a] | 88.60 [a] |
| C | 1363 [a] | 815.60 [a] | 59.86 [a] | 42.60 [a] | 10.80 [a] | 38.00 [a] | 90.00 [a] |

Average live weight, carcass, dressing %age, liver heart, gizzard and intestine weights (gm) of broiler fed different feed forms at an early period (4th week). [ab]Means followed by different letter in the column are significantly different (P<0.05)

**Table 4.**

| Groups | Live weight | Carcass | Dressing % | Liver | Heart | Gizzard | Intestine |
|---|---|---|---|---|---|---|---|
| A | 1992 [b] | 1150 [b] | 57.68 [b] | 47.82 [b] | 9.61 [a] | 34.27 [b] | 117.20 [a] |
| B | 2153 [a] | 1278 [a] | 59.33 [a] | 50.78 [a] | 10.38 [a] | 36.43 [ab] | 122.60 [a] |
| C | 2261 [a] | 1366 [a] | 60.39 [a] | 51.55 [a] | 11.02 [a] | 39.55 [a] | 127.00 [a] |

Average live weight, carcass, dressing %age, liver heart, gizzard and intestine weights (gm) of broiler fed different feed forms at an early period (6th week). [ab]Means followed by different letters in the column are significantly different (P<0.05)

## DISCUSSION

There are various physical forms of broiler feed, which are commonly used, i.e. mash, pellet and crumble. Mash form of feed is a complete feed form, that is ground and mixed together thus the chicks cannot easily separate out different mixed ingredients (Jahan et al., 2006); a pellet feed form is a modification in the mash feeding form, the mechanically or automatically pressing the mash feed form into hard and dry pellets or artificial grains is called pellet feeding system or form (Nir et al., 1994). First few weeks after hatch feeding to broilers is typically important. Fed either mash or crumble, more frequently early age feeding is by crumbling or crushing the large pellet (crumble). Mash or crumble feed followed by pellets has resulted in similar production in later age



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periods, therefore the correlations in favor of processed feeding different feed forms is observed between performance at an early age and at slaughter age of broiler (Cerrate et al., 2008).

In our experiment feeding and weight gain significantly increased in the group fed larger particle crumble feed, there is evidence from the present investigation that coarser feed grinding to a uniform feed particle can improve the performance of broiler chicken as compared to those feeding on mash feeding system. This effect positive effect may result from the particle size on gizzard development. Developed of gizzard is related with improved grinding activity. Our results agree with results of Abdollahi et al. (2011), where pelleted diets significantly increased the live weight and consumed more feed than feeding mash feed form diets. Possibility birds fed pellet diets consumed greater digestible protein results in significantly increased the live weight (Abdollahi et al., 2011).

Results of the current study are also in agreement with those of Dozier et al. (2010); who studied the effect of different feed form on the feed quality and broiler efficiency and identified that crumble improved feed efficiency and consume more feed over the corresponding mash feed. While Johannes (2001) found chickens on crumbles had the highest body weight at 42 days of age, followed by the chickens on the mash diet.

The best feed conversion was achieved on crumbles and ensured the heaviest body weight and the most efficient feed conversion on any given feed specification (Johannes, 2001). Jahan et al. (2006) reported that the higher, middle and the lower body weight were observed by feeding crumble, pellet and mash feed forms, respectively, in addition the live body weight gain was also higher in crumble feeding group. While Amerah et al. (2007) highlighted this counterintuitive cause may results from on the gizzard development from the progressive effect of feed particle size. Developed of gizzard is associated with increased grinding activity, significant in increased gut motility and better digestion of nutrients. It was suggested particles more than one mm in poultry diets to stimulate the development of gizzard (Nir et al., 1994).

Christopher et al. (2006) recommended that any mash or pelleted feeding can be used depending on the farmers' preferences; while Galobart and Moarn (2005) used mash and pelleted feed for broilers and found no major difference in the growth rate at the early age of growth up to later period of age of the birds fed on mash and those fed on pellets.

Mortality during the present trial was insignificant only five out of the 150 birds died and the mortality was not linked to any definite treatment, the net profit were also more in pellet fed birds (Data not shown), The entire success of the broiler industry can be improved by the physical pellet quality, nutrient availability and feed manufacture (Moritz et al., 2010).

The current study illustrates the influence of particle size on broiler performance; particle size for broiler feed is important factor expected size should not compromise in chickens feed, Mash diet decreases feed efficiency than crumble feed. The feed, water intake and body weight gain are positively connected with the production of broiler. In conclusion, present study emphasized that crumble feed of 1.5, 2.5 and 3.5 mm particle sizes in pre-starter, starter and finisher ration are preferred for higher broiler weight gain and receiving more net incomes.

## Author's contribution

F Nabi and MI Rind participated in the design of study. F Nabi and M Zulqarnain performed the experiments, IBM, MK Iqbal analyzed the data. MS and MR critically revised the manuscript for important intellectual contents. F Nabi wrote the manuscript. All authors read and approved the final manuscript.

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## Competing interest

The authors have declared that no competing interests exist.

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# CATTLE SELECTION CRITERIA AND FATTENING PRACTICES IN URBAN AND PERI-URBAN KEBELES OF DESSIE AND KOMBOLCHA TOWNS, ETHIOPIA

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**ABSTRACT**: The aim of this research was to investigate cattle selection criteria and fattening practices in urban and peri-urban kebeles of Dessie and Kombolcha towns, Ethiopia. In this study, structured questionnaire was administered to a total of 337 cattle fattener households. Complete enumeration techniques were applied to select urban and peri-urban kebeles. The results indicated culturally cattle fattening management activities were left to males and age, castration condition, sex, breed/type, farming condition and growth stage were the identified cattle selection criteria for fattening in both towns. As per group discussion, in both study towns peri-urban cattle fatteners were practiced cattle fattening in dry and wet season whereas urban cattle fatteners only practiced in dry season. In both study towns peri-urban cattle fatteners (100%) were dominantly fatten cattle once per year and on average one fattening duration take three, four and five months based on 24.8%, 52.3%, 22.8% and 33.3%, 28.4%, 38.3% households response, respectively. 100% of urban cattle fatteners were dominantly fattened cattle twice per year and on average one fattening duration has taken two months, and two and half months based on 75.6% and 24.4% of urban fatteners response in Dessie town, respectively; whereas, 62.1% and 37.9% of urban fatteners in Kombolcha town reported two, two and half and three months of duration, respectively. Therefore, to boost up the newly emerging urban as well as peri-urban cattle fattening sector scientific intervention should be initiated for further improvement in fattening practices based on the generated information.

**Keywords:** Cattle, Fattening system, Peri-urban, Urban

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## INTRODUCTION

Cattle fattening is an effective tool for poverty alleviation and has become an important business of the small farmers as well as urban dwellers. Particularly, the sector is good opportunity for employment and income generation for the rural poor, especially landless, destitute and divorced women (Ahmed et al., 2010). However, expansion and productivity is constrained quantitatively and qualitatively by inadequate and imbalanced nutrition, sporadic disease outbreak, scarcity of water, lack of appropriate livestock extension services, insufficient and unreliable data to plan the services, and inadequate information to improve animal performance, marketing, processing and integration with crop and natural resources for sustainable productivity and environmental health (Aynalem et al., 2011).

Improvement in cattle productivity can be achieved through identification of production constraints and introduction of new technologies or by refining existing practices in the system. In Ethiopia, the cattle production system in different agro-ecological zones is not studied fully and farmers' needs (EARO, 2001). Particularly, there is little information available on cattle fattening practices and cattle selection criteria for fattening in urban and peri-urban areas. To develop a sustainable beef cattle production system which starts at the farmers' level for production and ending at consumers' level for consumption, it is necessary to find out the existing beef cattle production systems. Therefore, to plan and develop improved cattle fattening practices, it is very important to



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investigate the existing cattle fattening practices (Teshager et al., 2013). Generally, assessment of the cattle selection criteria for fattening and fattening practices is a prerequisite to bring improvement in cattle productivity in the current study towns. Hence, the present study was conducted to appraise the assessment of the cattle selection criteria for fattening and fattening practices in urban and peri-urban kebeles of Dessie and Kombolcha towns of Ethiopia.

## MATERIALS AND METHODS

### Description of the study Area

The study was conducted in Dessie and Kombolcha towns. Dessie is located in northern part of Ethiopia in Amhara National Regional State, South Wollo Zone at a distance of 400 km from Addis Ababa, Ethiopia. Its astronomical location is at 11°8′N -11$^0$ 46' North latitude and 39°38′E- 41013' East longitude. Relatively it is bounded by Kutaber *Woreda* in the north, Dessie Zuriya *Woreda* in the east, and by Kombolcha town in the south. The topography of Dessie is a highland type surrounded by 'Tossa' mountain (Dawit, 2013). Its elevation ranges between 2,470 and 2,550 meters above sea level (http://en.wikipedia.org/wiki/Dessie, retrieved in December 2014). Annual maximum and minimum temperatures of Dessie are 23.7$^o$C and 9$^o$C, respectively, recorded in 2015 (Kombolcha meteorology station). Dessie is one of the reform towns in the region and has a city administration consisting of municipality, 10 urban and 6 peri-urban *kebeles*. Kombolcha is an industrial town found in the north-central part of Ethiopia in South Wollo Zone of the Amhara Regional State of Ethiopia. It is situated at a distance of 377 km from north of Addis Ababa, 505 km from the Regional capital city, Bahirdar, 23 km from the zonal town Dessie and 533 km from port Djibouti. Astronomically, the town is located at about 11$^0$6' N latitude and 39$^0$45' E longitudes. The delimitation of the town is bounded by Dessie Zuria Woreda in the North East and North West, Kalu Woreda in the South and Albuko Woreda in the South West (Muluwork, 2014). Mean annual rainfall is 1046 mm while annual maximum and minimum temperatures are 28.1$^o$C and 12.9$^o$C, respectively, recorded in 2015 (Kombolcha meteorology station). The town is located in a range of altitudes between 1,500 and 1,840 m above sea level. Kombolcha is one of the reform towns in the region and has a town administration municipality, 5 urban and 6 peri-urban kebeles (Eskinder et al., 2010).

### Sampling procedure and sample size

Based on objectives of the research and the parameter required pre tested structured questionnaire was prepared. The questionnaire comprised data or information on livestock holding and reasons, fattening experience, reasons of cattle fattening, livestock production systems, and cattle fattening systems and cattle fattening structure. Accordingly, those urban and peri-urban kebeles where cattle fattening is practiced, were considered in both study towns. Accordingly, 3 and 6 urban, 4 and 6 peri-urban *kebeles* were selected from Dessie and Kombolcha towns, respectively. Complete enumeration technique was applied to select urban and peri-urban *kebeles*. Due to manageable number of cattle fatteners, complete enumeration technique was applied to select individuals from urban and peri-urban *kebeles* of Kombolcha town. While, systematic random sampling technique for peri-urban and complete enumeration technique for urban cattle fatteners was applied to select individual household in Dessie town. In peri-urban kebeles of Dessie town, sampled households were determined based on the principle of probability proportional to size'. The sample size (n) was determined using the formula recommended by Arsham (2007), $N = 0.25/SE^2$ where: N: number of sample, SE: standard error, with the assumption of 4% SE. Consequently, 190 (41 urban and 149 peri-urban) from Dessie and 147 (66 urban and 81 peri-urban) cattle fatteners household from Kombolcha town were selected and interviewed.

### Data collection and analysis

A single visit formal survey was employed to collect all the required data. To strengthen the survey data, group discussions were held with individuals who have knowledge and experience on cattle fattening practices. In addition, key informant interviews were made with towns and kebeles Agricultural Experts, and Development Agents. Field observation was carried out to take different pictures. Researcher personal observation together with his practical experience in the study towns related to cattle fattening were also incorporated. Accordingly, focus group discussions and key informant interviews were conducted between February and April, 2016 whereas the household level surveys were carried out in May, June, July and August of the year 2016. Consequently, all the collected data were coded and entered into a data base using statistical package for social sciences (SPSS). Descriptive statistics such as mean, percentiles, and frequencies were used to analyze the data using the SPSS statistical software (SPSS for windows, release 20, 2011).



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## RESULTS AND DISCUSSION

### Family labor and time allocation for cattle fattening practices

In Dessie and Kombolcha towns 95.3% and 100 % of surveyed households, respectively, were allocated only male family member for cattle fattening practices. The current finding disagree with Yidnekachew et al. (2016) who reported that all the family members were participate while managing the fattening cattle at the house hold level. In urban kebeles of Dessie town 78% of the surveyed households was allocate male family member whereas the rest 22% used both male and female family labor. In case of Kombolcha town 100% of the interviewed household's totally left the cattle fattening practices for male family members (Table 2). In Dessie town urban cattle fatteners (100%) was used or allocated their labor throughout the day whereas in peri-urban kebeles 47.7% and 52.3% assigned averagely 2 -3 and 3-4 hours per day, respectively. In Kombolcha town 36.4%, 39.4% and 24.2 % urban cattle fatteners were allocated averagely 2-3, 3-4 hours and throughout a day whereas in peri-urban kebeles 48.1% and 52.9% cattle fatteners allotted averagely 2-3, 3-4 hours per day. As per group discussion cattle fatteners in both study towns allocate time for major cattle fattening activities as presented in Table 1. The overall households (100%) participated in the survey were reported that women's alone were not involved in cattle fattening practices in Dessie and Kombolcha towns. Particularly women have no role in tying and marketing (selling and purchasing) of fattening cattle with the exception that they were involved in the preparation of ration, feeding and manure management. Culturally in both study towns cattle fattening management activities were left to males. The reason behind why females are not involved in cattle fattening was as reported by the respondents has many folds. One of these was women's believed that cattle fattening requires enormous and aggressive energy and the sector is labor-intensive which demand high labor inputs during the period of operation which makes it difficult for females. Another reason was the female headed cattle fatteners by themselves were not ready to run the sector alone, they needs males support with them because of the aggressive nature of fattening cattle. But now a day females live in urban kebleles particularly in Dessie town become part of the business. This may be due to onset of urban agriculture, females organized with males in different cattle fattening association, acquire training about modern cattle fattening practices. In addition, traditional cattle fattening system transformed in to confined system. Therefore, the confined cattle fattening system was easy for proper cattle management and safety for the attendant. On the contrary, adult males were involved almost in all cattle fattening practices activities, such as, feed collection and storage, feed preparation and feeding, salting and watering, housing, tying and cattle cleaning, selling & buying. In addition to this, in decision making process to sell and /or to purchase a given cattle was handled by the males.

### Cattle selection criteria for fattening in Dessie and Kombolcha towns; Age of cattle

In Dessie and Kombolcha towns peri-urban cattle fatteners or farmers were totally (100% and 98.8%) respectively, choose the age group of cattle reached 4 and ½ years locally called '*yaderesse*', which means the milk teeth of a cattle totally replaced by the permanent one. The current finding similar to Addisu (2016) and Belete et al. (2010) who reported that cattle fatteners select and fatten mature and much older animals. On the other hand, 78% and 100% of urban cattle fatteners in Dessie and Kombolcha towns, respectively, were first-rate '*Hulet seber'* cattle which mean 3years aged. In Dessie and Kombolcha towns peri-urban cattle fatteners or farmers were totally choose the age group of cattle which reached '*Yaderesse*'. The farmers explained that when cattle reached the indicated age (4 and ½ years) develop better potential to handle farming equipment and able to pool out the equipment from the soil and able to pair with other ox with equivalent energy. In the course of cattle selection peri-urban cattle fatteners particularly farmers was primary focused on oxen which meets the criteria's for farming purpose and jointly in the second step they were focused on cattle which meet fattening criteria. On the other hand, urban cattle fatteners in both study towns were first-rate for those '*Hulet seber'* cattle which mean 3 years aged. The reason behind their selection was they believed that such cattle finished their growth properly, when they put finishing program directly start to build muscle and fat with in short period of time. Cattle age selection of urban cattle fatteners' was mostly influenced by the market condition. If no cattle supply at the market, except old and aged cattle, they forced to pick what they get from the market such as eye, horn and tail damaged cattle with lesser price. Urban cattle fatteners not selected aged and old cattle for fattening purpose because, they believed that aged and old cattle take much feed and long period to be fatten sometimes the animal may not be fatten and return back completely. Apart from these, the customers were not willing to purchase such cattle.

### Cattle castration condition for selection

Almost all of interviewed farmers (100%) in peri-urban kebeles of both study towns were point out that most of cattle to be fattened being culled oxen from farming, usually castrates. The current finding agrees with Bezahegn (2014) and Addisu (2016) who similarly reported farmers select castrated cattle for farming. On the other hand,



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urban cattle fatteners in urban kebeles of both study towns were purchased both castrated and UN castrated cattle (100%) for the fattening purpose (Table 2). Traditionally, the farmers bought oxen for farming not for fattening purpose. During the previous year's the major objectives and criteria of respondents in the course of oxen selection were whether or not the oxen can hold the farming equipment in the right or left direction, the behavior of cattle to lay down in the farming land during plowing, the ability to pool and stretch the farming equipment from the soil while plowing, ability of the cattle to pair with other oxen called '*mewajo*', experience of plowing and the aggressive nature of the ox which is related to castration condition. Currently, in all marketing areas farmers were checked the cattle using farming equipment before they provide money. Generally, farmers had chosen castrated animals. Even if non-castrated oxen bought for farming purpose they were castrated before they began farming. This is as a result of easy management of oxen and safe handling of the farming equipment. Peri-urban household's group discussions response indicated that the preference for purchasing younger steers for fattening was a rare case. Generally, farmers in peri-urban kebeles of both study towns were mostly purchased cattle primarily for farming not for fattening purpose. Traditionally, after they were finished plowing activities farmers put oxen for fattening. This practice has negative impact on modern cattle fattening practices and profitability of the sector. This is because, initially the oxen were not selected based on fattening cattle selection criteria.

Secondly, they were used aged oxen for fattening which led to cost incurring fattening process. Such oxen takes much feed and takes long time to be fatten. The meat comes from such type of fattened cattle become hard-hitting. But nowadays there is slight modification while purchasing cattle. On the other hand, urban cattle fatteners were purchased both castrated and UN castrated cattle for fattening purpose. This is because cattle type they were purchased majorly depends on the accessibility of cattle in the market. Most of the time urban cattle fatteners have no broad option to choose what they want. Simply they purchased the cattle regardless of considering the case whereas if the market allows to choosing, they were inclined to the castrated one. But now days, due to consumers' preference particularly cattle traders comes from Addis Ababa urban fatteners were emphasis on the use of UN castrated cattle for fattening purpose. Addis Ababa cattle traders and in general Addis Ababa cattle market needs UN castrated cattle. This may due to the shift of preference of the consumers from fatty to lean meat which is related to health. Apart from this, urban cattle fatteners reported that UN castrated cattle's were fatten with short period of time and with less cost than the castrated one. Again, the butcher house and hotel owners in the current both study towns believed that the meat comes from UN castrated cattle score higher weight (kg) than castrated one. Castrated cattle make them more profitable when they were sell out the meat in kilogram base without cooking for those customers who take the meat in their home. Therefore, to full fill the need of local market in both study towns urban cattle fatteners were feed castrated and un-castrated cattle. This is due to the local market preferred fatty cattle locally called '*Choma*'. In addition cattle fatteners were reported that castrated cattle become fatty with in short period of time and they are easy for fattening management. Farmers also preferred such cattle for farming purposes. In contrast, UN castration cattle have potential to gain weight fast and lose their weight fast after they gain weight. They create difficulty for fattening management and fattening equipment. Such cattle not demanded by local market.

**Table 1 -** Major activities of cattle fattening practices in Dessie and Kombolcha towns

| Cattle fattening activities | Total time allocated | By whom |
|---|---|---|
| Feed collection and transportation | 2 -3 months | Male mostly |
| Supplementary ration preparation | 2 hour per day | Male and females |
| Feeding equipment preparation & cleaning | 45 minutes per day | Dominantly females |
| Salting and concentrate feeding cattle's under feeding trough | 2 hour per day | Male and females |
| Cleaning fattening cattle | 1hour per week | Male only |
| Farm or barn cleaning | 1hour per day | Dominantly females |
| Cattle purchasing | 5 hour per day | Male only |
| Cattle trekking | 2 - 8 hour per day | Male only |
| Decision making to sell and purchase a given cattle and selling and purchasing | 1 to 2 weeks | Male only |
| Sun light exposer of cattle in exercising area | 3 hour per day | Male and females |
| Dry roughage supplementation at open shade area | 3 hour per day | Male and females |
| Water collection and watering using water trough | 30 minute per day | Male and females |
| Tying and untying cattle from barn and open shade | 30 minute per day | Male only |
| Medication and support | 10 minute | Male only |
| Market information collection from cattle traders | 30 minute per week | Male only |


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**Table 2** - Time allocation, gender contribution, sex, average age and cattle type selection, source, frequency and duration of cattle fattening in urban and peri-urban *kebeles* of Dessie and Kombolcha towns

| Parameters | Dessie town (%) | | | Kombolcha town (%) | | | Total mean N=337 |
|---|---|---|---|---|---|---|---|
| | PUK n= 149 | UK n = 41 | Total n=190 | PUK n= 81 | UK n = 66 | Total n=147 | |
| Time allocation | | | | | | | |
| • 2-3 hours/day | 4.7 (71) | 0.0 (0) | 37.4 (71) | 48.1 (39) | 36.4 (24) | 42.9 (63) | 40.2 (134) |
| • 3-4 hours/day | 52.3 (78) | 0.0 (0) | 41.1 (78) | 52.9 (42) | 39.4 (26) | 46.3 (68) | 43.7 (146) |
| • Throughout a day | 0.0 (0) | 100 (41) | 21.6 (41) | 0.0 (0) | 24.2 (16) | 10.9 (16) | 16.3 (57) |
| Family involvement | | | | | | | |
| • Male | 100 (149) | 78.0 (32) | 95.3 (181) | 100 (81) | 100 (66) | 100 (147) | 97.7 (328) |
| • Both (male & female) | 0.0 (0) | 22.0 (9) | 4.7 (9) | 0.0 (0) | 0.0 (0) | 0 (0) | 2.3 (9) |
| Sex preference | | | | | | | |
| • Male | 100 (149) | 100 (41) | 100 (190) | 100 (81) | 100 (66) | 100 (147) | 100 (337) |
| • Female | 0.0 (0) | 0.0 (0) | 0.0 (0) | 0.0 (0) | 0.0 (0) | 0.0 (0) | 0.0 (0) |
| Cattle preference | | | | | | | |
| • Castrated | 100 (149) | 0.0 (0) | 78.4 (149) | 100 (81) | 0.0 (0) | 55.1 (81) | 66.8 (230) |
| • Both | 0.0 (0) | 100 (41) | 21.6 (41) | 0.0 (0) | 100 (66) | 49.9 (66) | 35.8 (107) |
| Average age preferred | | | | | | | |
| • *'Yaderese'* | 100 (149) | 22.0 (9) | 83.2 (158) | 98.8 (80) | 0.0 (0) | 54.4 (80) | 68.8 (238) |
| • *'Hulet seber'* | 0.0 (0) | 78.0 (32) | 16.8 (32) | 1.2 (1) | 100 (66) | 45.6 (67) | 31.2 (99) |
| Cattle breed/type selection | | | | | | | |
| • Local | 100 (149) | 0.0 (0) | 78.4 (149) | 100 (81) | 0.0 (0) | 55.1 (81) | 66.8 (230) |
| • Local and hybrid | 0.0 (0) | 100 (41) | 21.6 (41) | 0.0 (0) | 100 (66) | 44.9 (66) | 35.8 (107) |
| Farming condition | | | | | | | |
| • Cattle comes from farming | 100 (149) | 0.0 (0) | 78.4 (149) | 100 (81) | 0.0 (0) | 55.1 (81) | 66.8 (230) |
| • Both | 0.0 (0) | 100 (41) | 21.6 (41) | 0.0 (0) | 100 (66) | 49.9 (66) | 35.8 (107) |
| Growth stage selection | | | | | | | |
| • Young | 0.0 (0) | 100 (41) | 21.6 (41) | 1.2 (1) | 100 (66) | 45.6 (67) | 33.6 (108) |
| • Old | 100 (149) | 0.0 (0) | 78.4 (149) | 98.8 (80) | 0.0 (0) | 54.4 (80) | 66.4 (229) |
| Source of cattle | | | | | | | |
| • Owen farm | 91.9 (137) | 0.0 (0) | 72.1 (137) | 37.0 (30) | 10.6 (7) | 25.2 (37) | 48.7 (174) |
| • Market | 8.1 (12) | 100 (41) | 27.9 (53) | 63.0 (51) | 89.4 (59) | 74.8 (110) | 51.3 (163) |
| Frequency of fattening | | | | | | | |
| • Once per year | 100 (149) | 0.0 (0) | 78.4 (149) | 100 (81) | 0.0 (0) | 55.1 (81) | 66.8 (230) |
| • Twice per year | 0.0 (0) | 100 (41) | 21.6 (41) | 0.0 (0) | 100 (66) | 49.9 (66) | 35.8 (107) |
| Average duration (months) | | | | | | | |
| • Two month | 0.0 (0) | 75.6 (31) | 16.3 (31) | 0.0 (0) | 0.0 (0) | 0.0 (0) | 8.2 (31) |
| • Two and half | 0.0 (0) | 24.4 (10) | 5.3 (10) | 0.0 (0) | 62.1 (41) | 27.9 (41) | 16.6 (51) |
| • Three month | 24.8 (37) | 0.0 (0) | 19.5 (37) | 33.3 (27) | 37.9 (25) | 35.4 (52) | 27.5 (89) |
| • Four month | 52.3 (78) | 0.0 (0) | 41.1 (78) | 28.4 (23) | 0.0 (0) | 15.6 (23) | 28.4 (101) |
| • Five and above | 22.8 (34) | 0.0 (0) | 17.9 (34) | 38.3 (31) | 0.0 (0) | 21.1 (31) | 19.5 (65) |

PUK = peri-urban *kebele* UK=urban *kebele* *numbers in the parenthesis indicate the number respondent*

### Sex selection

Totally (100%) in the urban and peri-urban *kebeles* of both study towns cattle fatteners were select male cattle for fattening purpose (Table 2). The current finding agrees with Fikru (2015) who reported that cattle fatteners prefer to fatten steer (52%) and bull (48%). Female cattle were not demanded due to so many reasons, for instance, females particularly cows are very expensive, municipality slaughtering houses discouragement and protection from such cattle to be slaughtered and cow may happens pregnancy at the middle of fattening. In addition even if females used in fattening program they generate less profit and the disadvantage weighted. Generally, unless otherwise exceptional case occurred related to disease in their reproductive organ and udder or purchased with great discount cattle fatteners in both study towns were not used female cattle's for fattening purposes.

### Cattle types/ breeds used for fattening

All of cattle fatteners in peri-urban areas of both study towns (100%) were reported that they used local cattle type for fattening purpose. On the other hand, (100%) urban cattle fatteners in both study towns were used local as well as hybrid cattle type (Table 2). All of cattle fatteners in peri-urban areas of both study towns were reported that they used local indigenous cattle type for fattening purpose. Ordinarily, peri-urban cattle fatteners or farmers were fattened their draught oxen and commonly fatten mature and much older animals for shorter durations. In addition, they believed that hybrid and exotic cattle were not manageable for farming purpose and such oxen takes long period to train them. Due to such reason, farmers were purchased cattle from their native



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areas and near neighbours. Because they were believed that cattle comes from other areas not be active for farming and adapt the area with short period of time or takes long time to adapt. On the other hand, urban cattle fatteners in both study towns were used local as well as hybrid cattle type for fattening purpose. There are four types of cattle in the current study towns and adjacent area. Raya Azebo cattle type in the north, Afar Danakil cattle type in the north east, Wollo high land zebu in the north west and south of the study area and intermediate cattle type which is a combination of all is found in the adjacent areas of Dessie Zuriya, Kutaber *Woreda*, Kombolcha, Albuko, Hayik, Afar (bati, mile), Raya Azebo, Kobo and Alemta. In the current both study towns particularly urban cattle fatteners were used dominantly Raya Azebo cattle type for the fattening purpose due to their better frame, full and large skeletal development. Yet again, Raya Azebo cattle type was better adaptation ability in relatively hotter areas just like Kombolcha and ability to hold muscle. On the other hand, Wollo highland zebu cattle comes from Kutaber, Woreeilu, Borena, Tenta, Ajibar, Mekaneslam was short relative to Raya Azebo and Afar cattle type and mainly used for farming purpose. In both study towns the urban cattle fatteners were reported that Wollo high land zebu cattle type was not dominantly selected in the first order for fattening purposes because of short anatomical structure and less ability to hold muscle. Such cattle type become small after fattening locally called '*Tikelel yilalu'* and less attract consumers in the market. In addition, the butchers also explained that they were less profitable because of small carcass yield compare to Raya Azebo cattle type.

On the other hand, the overall cattle fatteners described that the meat comes for Wollo highland zebu cattle were better tasty, flavour and aroma than Raya and Afar cattle type. Afar cattle were not selected for fattening purpose due to their long horn and difficulty for confined fattening management. Because they are wild and less adapted to the new environment particularly in Dessie town. In addition, cattle fatteners in both study towns were believed that horned cattle take long time to be fatten. The current study similar to Zewdu et al. (2008) and Dereje et al., (2008) who reported based on results of cluster analysis, it is concluded that, morphologically, at least three distinct cattle types are found, namely the Wollo Highland Zebu (comprising of cattle from Gimba, Were-Ilu and Kutaber sites), the Raya Sanga (Raya/Kobo site) and the Afar Sanga (Afar site). The fourth cluster is considered as intermediate cattle that are found in the adjacent areas of Sanga and highland zebu cattle types. The Wollo highland zebu cattle type comprises compact animals with short legs, ears and horns with coat color being dominantly black. On the other hand, the Raya and Afar Sanga cattle types found in lower altitude areas have longer legs, ears and horns reaching to maximum measurements for the Afar cattle. In both study towns urban as well as peri-urban cattle fatteners were not happy to fatten pure exotic cattle type. Because, at farmers level such cattle not manageable for farming. Such cattle required better and huge feed. Yet again, based on urban cattle fatteners and consumers report, the meat was not juicy, flavoured and aromatic likes local and hybrid cattle types. Consumers were not happy to purchase and slaughter such cattle meat. Due to such meat leads the discontinuation of consumers and purchaser marketing linkage. Generally, urban cattle fatteners dominantly used Raya Azebo cattle type for fattening purpose. Because such cattle comes from Raya and Hayik adopt better in Kombolcha area. But in Dessie town urban cattle fatteners used a combination of Wollo highland zebu and Raya Azebo cattle types.

**Ploughing condition of cattle during selection for fattening**

All of peri-urban cattle fatteners or farmers in Dessie and Kombolcha towns were used their own draught oxen for fattening purpose. On the other hand, urban cattle fatteners 100 % in both study towns were used both cattle which has and has no tillage experiences (Table 2). Mostly urban cattle fatteners were conditional during purchasing because the cattle selection process mainly depends on the cattle availability on market and the price. If there is better supply they preferred young but well framed and matured cattle and those cattle has no experience of plough and those cattle are unsuccessful during tillage. Unsuccessful oxen in tillage operation marketed with low price without competition with farmers.

**Months of cattle fattening and seasonal management**

As per group discussion, in both study towns peri-urban cattle fatteners or farmers were practiced cattle fattening in both dry and wet season. But mainly farmers were feed cattle during wet season after the end of main land preparation seasons '*Mehar*' (June –July- August and September). Peri-urban cattle fatteners or farmers in the current both study towns were purchased oxen around April, May and June and use them for tillage operation for '*Meher*' season. Upon finishing land preparation and sowing activities, they begin the feeding program starting from July up to October so as to finish and marketed them October to December. This is due to the availability of green feeds comes from farm such as '*Wokiya*' different weeds collected from the planation plot and green hay comes from the adjacent plantation area called '*Wober*'. Regardless of cattle weight gain farmers kept the cattle in wet season. Besides, conditionally according to the feed resources availability, farmers were practiced cattle fattening in dry season. But mostly they were used the stored feed resources especially hay and different industrial by



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products come from the adjacent urban areas. On the other hand, all of urban cattle fatteners (100%) in both study towns were not practiced cattle fattening in wet or cool and rainy season particularly in July, August, September and October due to difficulty to manage fattening cattle and cattle's needs a lot of feed resources with less gain. Instead, urban cattle fatteners dominantly practices fattening from November to June. In the indicated months there is relatively hotter environmental condition. In the current both study towns starting from the end of September urban cattle fatteners were twitch their hands to market to collect cattle used for fattening purpose and accumulates different feed resources such as hay and different factories byproducts like wheat bran, Dried Brewery Grain, poultry litter and leftover of human feed processing enterprises. In both study towns and in the adjacent *Woredas* in October, November and December the cattle and feed prices are relatively lower. There was better availability of feed and cattle resources in the market relative to other months. In addition, no feed resources competition between farmers and urban cattle fatteners. This is because of peri-urban cattle fatteners or farmers in both study towns were used chiefly different feed resources come from their own farm. Farmers were not considered feed ingredients come from their farm as a cost. Secondly, almost all of farmers were ready to sell cattle and collect cash income for the purpose of different expense like student cloth, exercise books and for laborer expense for different ceremony '*Debo*' to harvest and collect different crops and pasture.

**Source of cattle for fattening**

According to survey result all of cattle fatteners in Dessie and Kombolcha towns were obtained fattening cattle from their own farm (62.2%) and market (33.3%). Purchasing from market was the sole source for urban and for those peri-urban cattle fatteners who have no livestock in both study towns (100%). Those peri-urban cattle fatteners or farmers who have livestock acquire cattle for fattening from their own farm (Table 2). The current result cattle similar to Fikru (2015) who reported fatteners obtained fattening cattle from farm-gate (62.2%), primary market (33.3%) and secondary market (4.5%).

**Anatomical and physical considerations to purchase cattle for fattening**

In Dessie and Kombolcha town's cattle fatteners whether used purchased or own cattle for fattening purposes, most cattle fatteners were considered different anatomical and physical criteria as mentioned in Table 3 and Figure 1.

**Table 3** - Anatomical considerations and physical observation to purchase cattle for fattening

| Anatomical considerations | Physical observation | Local expressions in Amharic |
|---|---|---|
| • Age | • Dentition and horn | • *Yaderesee, hulet seber* |
| | | • *Horn smooth (small) and rough (large age)* |
| • Frame and skeletal development | • Well framed, full and large skeleton | • *Atintu yebesele and atintam* |
| • Body length | • Lengthy | • *Shintam yehone* |
| • Height | • Elevated | • *Zeleg yale* |
| • Color | • Red, black, white and black | • *keyi, sendema,burabure,dalcha, gureaza* |
| • Body condition | • Not emaciated | • *Betam yalkessa* |
| • Muscle | • Well-muscled | • *Belit yalew* |
| • Overall appearance | • Attractive | • *Melke-melkam* |
| • Back and rear side | • Wide | • *Kitu sefi/fegaraw sefi/ kit kifit* |
| • Horn size | • Medium | • *Mekekelegna kend* |
| • Body shape | • Rectangular | • *Yetesetekakele sewnet yalew/wot sewnet yalaw* |
| • Neck | • Wide and long | • *Angetu sefi* |
| • Hump | • Well developed and straight up ward hump | • *Ket yale shagna yalew* |
| • Back bone | • Wide and straight | • *Ket yale wogeb and sefi wogeb* |
| • Tail | • Wide and up tail | • *Jiratu yetenesa and sefi* |
| • Dewlap | • Well-developed dewlap | • *Dalga yalew* |
| • Tie and round | • Broad and wide tie and round | • *Sefi tafa* |
| • Leg | • Straight leg | • *ket yale egger yalaw* |
| • Claw | • Wide to hold animal weight and muscle | • *Sefi kote* |
| • Hide | • Soft | • *Yelala koda* |
| • Maturity | • Matured but not young | • *Besel yale* |
| • Any disability | • One of the eyes not functional, broken teeth, no tail | • *Ayinu yetefa, jiratu korata, tirisu yetesebere* |
| • Abdomen and belly | • Small belly and gut | • *Tinish hode, zergif yalhone* |



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Figure 1 - Selected Wollo highland zebu oxen on the phase of fattening

**Frequency and duration of cattle fattening**

In both study towns peri-urban cattle fatteners (100 %) were dominantly fatten cattle once per year which was mainly practiced year after year following the end of main farming season. On average in peri-urban *kebeles* one fattening duration take three, four and five months based on 24.8%, 52.3% and 22.8% households response in Dessie and 33.3%, 28.4% and 38.3% in Kombolcha town, respectively. On the other hand, 100 % of urban cattle fatteners were dominantly fattened cattle twice per year in both study towns. On average one fattening duration has taken two month, and two and half months based on 75.6 % and 24.4% of urban fatteners response in Dessie town, respectively, whereas, 62.1% and 37.9 % of urban fatteners in Kombolcha town reported two and half and three months, respectively (Table 2).

Generally, urban cattle fatteners in both study towns were commonly fattened cattle twice a year in two different periods or rounds. The **first round** of cattle fattening were undertaken during October—November—December -January due to relatively low price and better availability of both of feed and cattle resources. The **second round** of cattle fattening were commenced for the duration of January –February –March—April and June. This is due to better selling price and no cattle market competition with grass fattener farmers. The current result in line with Addisu (2016) who reported that cattle fattening is starting from mid-February up to June, this may be due to the price of cattle for fattening is low in the market. Peri-urban cattle fatteners in both study towns were fatten cattle mostly once per year in June, July, August, September of the years which is after the end of land preparation of main farming season locally called '*Meher*'. Land preparation of main farming season '*Meher* was locally undertaken with in the month of April- May- June. But, in both study areas particularly urban cattle fatteners via calculated the profit margin at the middle or anytime of the fattening they will sell a given cattle without maintain the fattening duration. Mostly they were applying spread price fattening approach. They focus on the profit as well as the market opportunities. Generally, fattening duration of a given cattle highly depend on the body condition of the cattle in the course of purchasing, the profit margin and the marketing opportunities.

## CONCLUSION

As inference in both study towns cattle fattening management activities were left to males. Females are not involved or limited participation in cattle fattening sector in both study towns. Age, castration condition, sex, breed/type, farming condition and growth stage was the identified cattle selection criteria for fattening in Dessie and Kombolcha towns. In both study towns peri-urban cattle fatteners and farmers were practiced cattle fattening in dry and wet season whereas urban cattle fatteners only practiced in dry season. Therefore, to boost up the newly emerging urban as well as peri-urban cattle fattening sector scientific intervention should be initiated for further improvement in fattening practices based on the above generated information.

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### Conflict of interests

The authors declare that they have no conflict of interest with respect to the research, authorship, and/or publications of this article. The competing interest is assured by copy right agreement and there is no computing interest in this research paper.

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# EFFECT OF GRADED LEVELS OF BROWSE FORAGE (*Balanites aegyptiaca*) LEAVES INCLUSION IN THE DIETS OF GROWING RABBITS

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**ABSTRACT**: Thirty mixed sex cross breeds (*chinchilla x California x New Zealand*) weaner rabbits aged 4 weeks old were used to evaluate the effect of graded levels of browse forage (*Balanites aegyptiaca*) leaves inclusion in the diets of growing rabbits on growth performance and nutrient digestibility of weaner rabbits. Five diets were formulated, treatment 1 (control), 2 3 4 and 5 in which Groundnut haulm was replaced with *Balanites aegyptiaca* at 0%, 5%, 10%, 15%, and 20% respectively. The rabbits were allotted to the five treatments (T1, T2, T3, T4, and T5) with two rabbits per replicate and six rabbits per treatment in a randomized complete block design. The rabbits were fed with the experimental diets and clean drinking water *ad libitum* for experimental period of eight weeks (56 days). All the parameters under observation showed significant (P<0.05) difference among the treatment groups. In conclusion *Balanites aegyptiaca* leave meal can replace groundnut haulm without adverse effect on the rabbits.

**Keywords**: Rabbit, *Balanite aegyptiaca* and Groundnut Haulm

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## INTRODUCTION

There is global awareness on the shortage of animal protein supply in the tropics (Adekunle and Ajani, 1999). The production of ruminants such as cattle, sheep and goats have not been able to bridge the gap because of their long production intervals, feed shortage, poor genetic make – up and disease incidence among other factors. Ayinde and Aromolaran (1998) reported that there has been continuous rise in the cost of production of cattle, sheep, goats and poultry and implored researchers to explore the potentiality of alternative feeds for livestock feeding. Now, there has been rising awareness on the virtues of rabbit production in developing countries as a means of alleviating world's animal protein shortage. Taiwo et al. (2005) attributed this to several advantages of rabbit over other livestock in the tropics and advocated its increased production in Nigeria. However, Ayinde and Aromolaran (1998) showed that feed accounted for 65.75% of the total cost of rabbit production and recommended research into alternative and cheaper feeds for rabbits in Nigeria.

Rabbits are highly prolific and have short generation intervals (Cheeke, 1999). Rabbit meat has high biological value and contains with crude protein (21%), fat (10%), low cholesterol, low sodium (0.25 mg/g) and higher proportion of linoleic and linolenic fatty acids (Cheeke, 1999). Rabbit grow rapidly and their growth rate is comparable to that of broiler chicken (Rao, 1999). Despite these attributes of rabbits, their production has not received the desired attention in the tropics. However, the adoption of proper nutritional strategies will greatly enhance the productivity of rabbits.

Browses are important in providing nutrient to grazing ruminants in arid and semi-arid environments where inadequate feeds are a major constraint for livestock production (Aganga and Tshwenyane, 2003). Tree fodders maintain higher protein and mineral contents during growth than grasses, which decline rapidly in quality with maturity (Shelton, 2004). Tree fodders are important source of nourishment for grazing ruminants and as



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supplements to improve the productivity of herbivores fed on low quality feeds. Browse forages form part of the complex interactions between plants, animals and crops (Aganga and Tshwenyane, 2003), the positive aspect of which is to help balance a plant-animal-soil ecosystem from which there is sustainable source of feeds (Devendra, 1994).

*Balanites aegyptiaca* is a species of tree growing in different ecological conditions. It can thrive well in areas with 100 to 1000 mm annual rainfall and mostly distributed in semi arid and arid zones of tropical Africa (Von Maydell, 1983). This specie of tree is available in the Northern part of Nigeria with highest number in the Northeastern Nigeria. *Balanites aegyptiaca* have been reported to have anti-inflammatory and analgesic, anthelmintic, antioxidant, antidiabetic, antinoceptic, hepatoprotective, antibacterial and larvicidal activities in animals (Dubey et al., 2011). *Balanites aegyptiaca* like Acacia Senegal (Diallo, 1997) and *A.* nilotica (Tybirk, 1989) shows a synchronization between male (internal stamina cycle) and female phase (Ndoye et al., 2004). *Balanite saegyptiaca* being a browse plant have been reported to improve the feeding potential of ruminant animals in the semi arid (Njidda and Ikhimioya, 2010). Therefore, the objectives of this Research is to evaluate the growth performance and nutrient digestibility of weaner rabbits fed graded levels of inclusion of *Balanites aegvptiaca* as a replace for ground haulm in the diets

## MATERIALS AND METHODS

The study was carried out at the Rabbitry unit of the Department of Animal science, Faculty of Agriculture, Bayero University Kano, Nigeria. Thirty healthy (Chinchilla) weaner rabbits were purchased locally from the local market. Rabbit were randomly allotted to five dietary treatment groups with six rabbits per treatment and three replications per treatment in a completely randomized design. *Balanites aegyptiaca* leaf meal was fed at 0, 5, 10, 15, and 20% levels in the ration for treatment 1 (control), 2, 3, 4 and 5 respectively. The experimental diets and clean drinking water were provided *ad libitum*. The experiment lasted for eight weeks (56 days) in a randomized complete block design (RCBD). The ingredient composition of the experimental diets is presented in Table 1 and proximate composition of the experimental diets in Table 2. All data collected were subjected to analysis of variance (ANOVA) of completely randomized design. Significant difference ($P<0.05$) among treatment means were determined by the least significant difference (LSD) as outlined by Steel and Torrie (1980).

## RESULTS AND DISCUSSION

Proximate composition of the experimental diet of weaner rabbit fed graded level of *Balanites aegyptiaca* leaves is showed in table 2. The values of crude fibre (CF), acid detergent fibre (ADF), neutral detergent fibre (NDF) and dry matter (DM) digestibility were higher in treatment 3. The ether extract (EE) levels (4.49 to 6.35%) increased with increase in level of *Balanites aegyptiaca* leaves in the diets. The EE indicates the fat contents of the experimental diets. The crude protein content (CP) ranged from (16.28-17.86%) treatment 1 (control) showed the highest and followed by treatment 5 (20%) inclusion level of test ingredients. The value obtained for CP in this study is adequate for growing rabbits (Saleh et al., 2014). This is also similar to work of Njidda and Isidahomen (2010). The crude fibre levels of the diets ranges (28.42 - 30.09%) were higher than the 25% recommended by Irbeck (2001) for growing rabbits though higher levels in this study. The fat component of the diets as ether extract values were lower than the range (20-25%) fat levels recommended for young rabbits by Irlbeck (2001). The dry matter content of the diet was observed to be higher in all the treatments with the highest value in T3 (90.75%). The ADL values ranged from (5.16 to 6.26%). The values were much lower than those reported by Okoli et al. (2003) for southeastern browses of Nigeria. The values for NDF were observed to be higher in T3. The NDF values are however lower compared to the values reported by Njidda (2011) for semi arid browse forages. The Growth Performance and nutrient digestibility of rabbit fed the experimental diets are showed in table 3. Reduced growth performance was observed in diet B (5%, *Balanite aegyptiaca* leaves) and this may be due to decrease in dietary fibre as reported also by Osakwe et al. (2008) who used cassava peel as replacement for maize. The mean weight gain recorded in this study showed significant ($P<0.05$) difference among the treatment groups. The result obtained from this study can be compared favourably with the reports of Agunbiade et al. (1999) and Schiere (1999). The increased mean weight gain of rabbits fed diet C (10%), D (15%), and E (20%) over those fed diet A (0%) and B (5%) respectively, could be attributed to the favorable effect of fibre, termed a "ballast" effect (Colin et al., 1976). DMI in this study showed significant ($P<0.05$) difference among the treatment groups. The value ranges from 64.40 to 83.03 g/day is higher than the findings of Abubakar et al. (2006) who reported a DMI range of 60.95 to 70.22 g/day for weaner rabbit fed varying levels of spent sorghum residue in diets. The variation may be as a result of the different test ingredients used for the studies. The crude protein digestibility (CPD) showed significant ($P<0.05$) difference among the treatment groups. Treatment C and D were generally higher (77.28 to 79.92%) further confirming the assertion



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that protein in concentrate diet (De Blas et al., 1981) and in forage, Cheeke et al. (1987) are efficiently utilized by rabbits. Onifade et al. (1993) made similar observation. The crude fibre digestibility (CFD) indicates significant (P<0.05) difference among the treatment groups. Treatment B showed the higher value .the values (64.75 - 75.02%) is higher than the value (56.13 to 68.15%) reported by Jegede et al. (2008) for growing rabbits fed diets containing malted sorghum sprout but higher than the result (25.48 to 26.19%) recorded by Murin et al. (2002) when maize was replaced with sorghum in the diets of growing rabbits. The variation is attributed to the test ingredients. Ether extract (EE), ash, acid detergent fibre (ADF), neutral detergent fibre (NDF) and Acid detergent lignin (ADL) all showed significant (P<0.05) difference among treatment groups. The EE, ADF, NDF and ADL showed higher value in treatment C (10%) inclusion level of test ingredients. This indicates that inclusion level at 10% favour digestibility of the parameters mentioned above and it could be due to fact that digestibility of feed is influenced not only by its own composition but also by the composition of other feed consumed with it which is in line with the findings of Mc Donald et al. (1995).

**Table 1** - Percentage composition of the experimental diet.

| Parameters \ Diets | Diet 1 | Diet 2 | Diet 3 | Diet 4 | Diet 5 |
|---|---|---|---|---|---|
| White maize | 37.35 | 37.35 | 37.35 | 37.35 | 37.35 |
| Groundnut cake | 15.00 | 15.00 | 15.00 | 15.00 | 15.00 |
| Ground haulm | 20.00 | 15.00 | 10.00 | 5.00 | 0.00 |
| Maize bran | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Fish meal | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| *Balanite aegyptiaca* | 0.00 | 5.00 | 10.00 | 15.00 | 20.00 |
| Wheat offal | 10.00 | 10.00 | 10.00 | 10.00 | 10.00 |
| Bone meal | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Salt | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Premix* | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |

Premix* (grow fast) Manufactured by Animal Care Service Consults Nigeria Ltd., Lagos, supplying the following per kg of premix; vitamin A = 32,000,00 IU, vitamin B3 = 640,000 IU, vitamin E = 2,000 IU, vitamin K = 800 mg, thiamine (B1) = 600 mg, riboflavin (B2) = 1600 mg, pyridoxine (B6) = 600 mg, vitamin B12 = 4 mg, pantothenic acid = 2000 mg, folic acid = 200 mg, biotin = 8 mg, choline = 80 mg, antioxidant = 50 g, managanese = 32 g, zinc = 20 g, iron = 8 g, copper = 2 g, iodine = 0.48 mg, selenium = 80 mg and cobalt = 80 mg.

Table 2 - Proximate composition of the experimental diet of weaner rabbit fed graded level of *Balanites aegyptiaca* leaves.

| Parameters (%) \ Treatments | A (0%) | B (5%) | C (10%) | D (15%) | E (20%) |
|---|---|---|---|---|---|
| Dry matter | 89.86 | 88.96 | 90.75 | 91.23 | 89.62 |
| Ash | 7.68 | 8.11 | 7.92 | 8.23 | 8.10 |
| Crude protein | 17.86 | 16.93 | 16.28 | 16.75 | 17.80 |
| Ether Extract | 4.49 | 5.62 | 5.87 | 6.18 | 6.35 |
| Crude fibre | 28.42 | 29.16 | 30.09 | 29.62 | 28.76 |
| ADF | 33.11 | 34.24 | 36.12 | 35.26 | 33.40 |
| NDF | 41.64 | 43.16 | 45.11 | 44.23 | 42.18 |
| ADL | 6.11 | 5.16 | 5.43 | 5.76 | 6.26 |

ADF-Acid detergent fibre, NDF-Neutral detergent fibre, ADL-Acid detergent lignin

Table 3 - Performance characteristics and Nutrient digestibility of weaner rabbit fed graded level of *Balanites aegyptiaca* leaves.

| Parameters \ Treatments | A (0%) | B (5%) | C (10%) | D (15%) | E (20%) | SEM |
|---|---|---|---|---|---|---|
| Initial weight g/day | 833.30 | 900.00 | 791.70 | 828.30 | 800.00 | 35.77 |
| Final weight g/day | $900.00^{c}$ | $858.30^{cd}$ | $1016.70^{b}$ | $1266.70^{a}$ | 1000.00 | 43.11* |
| Total weight gain (g) | $66.70^{c}$ | $-41.70^{d}$ | $225.00^{b}$ | $438.30^{a}$ | $200.00^{b}$ | 36.49** |
| Daily weight gain (g) | $0.0529^{d}$ | $-0.033^{e}$ | $0.1786^{b}$ | $0.3470^{a}$ | $0.1587^{c}$ | 0.029* |
| DMI g/day | $72.98^{ab}$ | $64.40^{b}$ | $75.62^{ab}$ | $83.03^{a}$ | $82.27^{a}$ | 7.089** |
| **Nutrient Digestibility** | | | | | | |
| Dry matter | $90.50^{a}$ | $65.22^{c}$ | $91.43^{a}$ | $91.22^{a}$ | $90.11^{b}$ | 0.972* |
| Ash | $81.48^{a}$ | 73.52 | $79.82^{b}$ | $81.72^{a}$ | $76.82^{c}$ | 0.713* |
| Crude protein | $74.17^{c}$ | $70.40^{d}$ | $77.28^{b}$ | $79.92^{a}$ | $74.03^{c}$ | 0.811* |
| Ether Extract | $94.59^{b}$ | $93.81^{c}$ | $96.84^{a}$ | $96.95^{a}$ | $94.97^{b}$ | 0.154* |
| Crude fibre | $73.13^{b}$ | $75.02^{a}$ | $69.12^{c}$ | $64.75^{d}$ | $65.25^{d}$ | 1.017* |
| ADF | $64.79^{b}$ | $54.94^{d}$ | $63.11^{c}$ | $69.64^{a}$ | $57.41^{e}$ | 1.261* |
| NDF | $63.47^{c}$ | $55.33^{e}$ | $65.88^{b}$ | $70.28^{a}$ | $58.31^{d}$ | 1.239* |
| ADL | $64.36^{b}$ | $54.28^{d}$ | $59.79^{c}$ | $67.93^{a}$ | $54.81^{d}$ | 1.302* |

$^{a, b, c, d}$ and $^{e}$ Means along the same row with different superscript arse significantly different (p<0.05) difference. ADF-Acid detergent fibre, NDF-Neutral detergent fibre, ADL-Acid detergent lignin and SE-Standard error, ** mean highly significance and *mean significance



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## CONCLUSION

Based on this study Balanites *aegyptiaca,* showed potentials to replace ground haulm without adverse effect on the rabbits performance and nutrient digestibility. I recommend that research should be carry out on physiology of rabbit fed *Balanite aegyptiaca.*

### Competing interests

The authors declare that they have no competing interests.

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(Revised on 22 January 2015)



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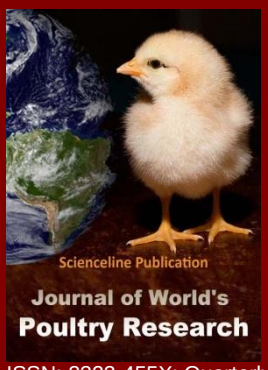


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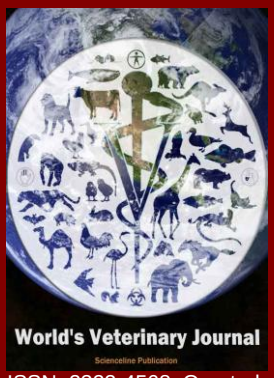


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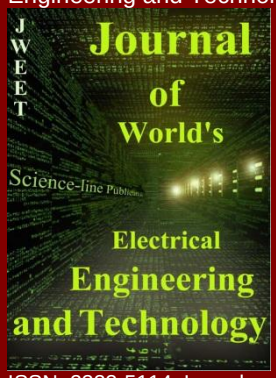


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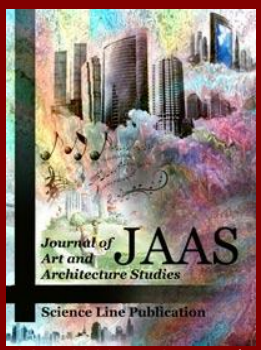


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