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# Effects of Concentrate Level on Lactation Performance of Horro Cows Fed Rhodes Grass Hay (RGH) as a Basal Diet at Guduru Animal Production and Research Center, Western Ethiopia

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## አህፅሮት

*በሆሮ ዳልጋ ላሞች የወተት ምርት፣ የወተት ተዋፅዖዎች፣ የመመገብ አቅም እና የሰውነት ክብደት ለውጥ ለመገምገም የተቀናጁ መኖን (ኮንሰንትሬት) በተለያየ መጠን በመጠቀም በወለጋ ዩኒቨርሲቲ ጉዱሩ እንስሳት ርባታና እና ምርምር ማዕከል ላይ ምርምር ተደርጓል፡፡ ለዚህም ምርምር በአማካይ ተመሳሳይ የሰውነት ክብደት እና ሁኔታ ያላቸው 16 የሆሮ ላሞች ከጉዱሩ እንስሳት ርባታና እና ምርምር ማዕከል ተመርጦ ለአራት የአመጋገብ ስርዓት ተመድበዋል፡፡ አራቱ የአመጋገብ ስራዓቶቹም፣ ርሆደስ ሳር + 0.5 ኪ.ግ የተቀናጀ መኖ (T1)፣ ርሆደስ ሳር + 2 ኪ.ግ የተቀናጀ መኖ (T2)፣ ርሆደስ ሳር + 3 ኪ.ግ የተቀናጀ መኖ (T3)፣ እና ርሆደስ ሳር + 4 ኪ.ግ የተቀናጀ መኖ (T4) ነበሩ፡፡ 15 የማላመጃ ቀናትን ጨምሮ ሙከራው የተካሄደው ለ90 ቀናት ነዉ፡፡ አማካይ ደረቅ ንጥረ ነገር መጠኑ 5.98% ነበር። አጠቃላይ ፕሮቲን፣ ኒውትራል ዲተርጀንት ፋይበር፣ አሲድ ዲተርጀንት ፋይበር፣ አሲድ ዲተርጀንት ሊግኒን እና የኦርጋኒክ ቁስ መጠን በቅደም ተከተል 0.78በመቶ፣ 4.74በመቶ፣ 2.26በመቶ፣ 1.44በመቶ እና 4.89በመቶ ነበሩ፡፡ ርሆደስ ሳር እና አራት ኪ.ግ የተቀናጀ መኖ የተመገቡ ላሞች የወሰዱት አጠቃላይ ደረቅ ንጥረ-ነገር የላቀ ነው፡፡ አማካይ የወተት ምርት 3.12 ሊትር ነበር፡፡ የተቀናጀ መኖ መጠን በጨመረ ቁጥር የወተት ምርቱም ጨምሯል፡፡ ከላክቶስ (5.73በመቶ) በስተቀር የወተት ተዋፅዖዎች ከፍተኛ ልዩነት ነበራቸው፡፡ ርሆደስ ሳር እና 0.5 ኪ.ግ የተቀናጀ መኖ (T1) የተመገቡ ላሞች የወተት ቅባት መጠን ከተቀሩት የላቀ ነበር፡፡ በአጠቃላይ 4 ኪ.ግ የተቀናጀ መኖ የተመገቡ ላሞች በቀሪዎቹ የአመጋገብ ስርዓቶች ላይ ከሚገኙት ላሞች የበለጠ የመመገብ አቅም፣ የወተት ምርት እና የወተት ተዋፅዖ ንጥረ-ነገሮች የተሻሉ ነበሩ፡፡ ለወደፊቱ የምርምሩን ፍሬያማ እና ኢኮኖሚያዊ ፋይዳ በቀጣይነት ለመገምገም ተጨማሪ ጥናት በመስክ ላይ መደረግ አለበት፡፡*

## Abstract

*An experiment was conducted at Guduru Animal Production and Research Center (GAPRC) of Wollega University to evaluate effects of different levels of formulated concentrate supplementation on milk yield, milk compositions, feed intake and body weight gain of Horro cows. Sixteen early lactating Horro cows with the same body weight and condition were selected from GAPRC. Experimental cows were assigned to four dietary treatments using a randomized complete block design with four replications. Cows that varied in parity were used as blocking factors in the present trial. The treatments used were: RGH +0.5Kg of concentrate (T1), RGH +2Kg of concentrate (T2), RGH + 3Kg of concentrate (T3), and RGH + 4Kg of concentrate (T4). The experiment was conducted for 90 days with an acclimatization period of 15 days. Dry matter and nutrient intakes of cows significantly ($p<0.05$) varied between treatment groups. Mean dry matter intake was 5.98%. Mean total crude protein, total neutral detergent fiber, total acid detergent fiber, total acid detergent lignin and total organic matter intake (%)*

*were, 0.78, 4.74, 2.26, 1.44, and 4.89 respectively. Total dry matter intake of cows fed on T4 was higher than those cows maintained on dietary T1, T2, and T3. The mean milk yield per cow per day was 3.12 liter. It has increased across the dietary treatment with an increase in the rate of concentrate supplementation. Protein, fat, total solid, solid-not-fat, and Ash composition of milk (%) were, , 3.41, 3.48, 13.37, 9.89, and 0.75 respectively, where milk compositions except for Lactose (*5.73%) *content had significant difference (P<0.05) among the treatment groups. Milk fat contents of cows fed on T1was higher than those cows maintained on dietary T2, T3 and T4. Except the numerically higher body weight observed for cows receiving T4, initial and final body weights of experimental cows didn't show variation (P>0.05) with changes in dietary treatments. In general, cows supplemented with 4kg of formulated concentrate had improved feed intake, milk yield and milk nutrient compositions than cows on the remaining dietary treatments. The further study shall be conducted on the productive and economic response of local cows maintained on such diet over successive lactation to evaluate the significance of the study at the field level.*

**Keywords**: Horro cows, Concentrate, Feed intake, Milk Yield, Milk composition

## Introduction

Ethiopia is reported to be gifted with the huge livestock population in Africa. Livestock population was about 60.39 million cattle, 31.30 million sheep, 32.74 million goats, 56.06 million poultry, 2.01 million horses, 8.85 million donkeys, 0.46 million mules, 1.42 million camels and 5.92 million hive bee colonies. Its estimated total production potential for the rural sedentary areas of the country was about 3.32 billion liters of cow milk, 327.64 million liters of camel milk, 66.22 million kilograms of honey and 136.76 million of eggs (Central Statistical Agency 2017/18).

In Ethiopia, dairy production is one of the sub-sectors of livestock production systems and contributes to the livelihood of the owners through important sources of food and income (Yigrem *et al.*, 2008). But anticipated productivity of dairy animals is not concomitant to the high population of the species. This mismatch between productivity and high population of cattle breeds could be attributed to poor nutrition, poor genetic potential, lack of proper management, animal diseases (Adugna, 2008). Seasonal fluctuation in the availability and quality of feed has been a common phenomenon, inflecting serious changes in livestock production (Demissu *et al.*, 2015). As a result of severe feed shortage during the dry period, the supply of protein and soluble carbohydrates, which are important for the proliferation of rumen micro-organisms from these feed resources, is marginal.

Most practice of extensive system of dairy production in Ethiopia uses different green herbages such as leguminous trees and herbaceous legumes that grown on farm for protein supplements whereas energy source concentrate supplements are scarce in these production systems (Diriba, 2014). Increasing levels of concentrates or specific nutrients, especially in dairy cattle improves animal response (Teixeira *et al.*, 2013). Horro cattle are sole source of milk production and draught power as well as a source of food, cash and prestige, and means of storing wealth in western part of Ethiopia. The overall mean reported daily milk yield, lactation milk yield and lactation length of Horro cattle were 1.65 liters, 475.85 liters and 9.57 months, respectively (Ayantu, 2012). They can also yield milk of 7% fat content (O'Mahony, 1988). However, the overall dairy productivity of Horro cows was under optimum mainly due to malnourishment. Bako agricultural research center made a great effort for several years to improve dairy technologies which include improved breed and feed in and around Bako areas. They also made efforts to promote these dairy technologies in potential dairy production areas (BARC, 2014). Diribe *et al*. (2016) studied feed intake, milk yield and composition, and profitability of horro cows fed on Rhodes grass hay supplemented with *Ficus sur (Cv. Forssk)* Fruits. Dereje and Temesgen (2016) also studied effects of urea-molasses multi-nutrient blocks supplementation on some production parameters of lactating Horro cows in Guduru Animal Production and Research Center. But, effects of concentrate level on lactation performance of lactating Horro cows were not evaluated in the center so far. Therefore, this study was generally designed to evaluate effects of different levels of formulated concentrate supplementation on milk yield, milk compositions, feed intake and body weight gain of Horro cows fed a basal diet of Rhodes grass hay.

## Materials and Methods

The experiment was conducted at Wollega University Horro-Guduru Animal production and Research Center, located in Horro Guduru Wollega zone of Oromia National Regional state, located at about 275km west of Addis Ababa along Gedo-Fincha sugar factory main road with geographical coordinates of $09^{0}29'$N and $37^{0}26'$E, and at an altitude of approximately 2296 meters above sea level (m.a.s.l). The area has one long rainy season extending from March to mid-October (Olana, 2006). Mean monthly mean temperature varies from $14.9^{0}$C to $27.5^{0}$C and its annual rainfall ranging from 1000 – 2400 mm.

## Management of Experimental Animals

Sixteen Lactating local zebu (Horro) cows at their early stage of lactation weeks and having same body condition were selected from the total herd size available on the center for this study. Just before the actual commencement of the feeding trial, all experimental animals were weighed and dewormed with a broad spectrum anti-helminthic (Albendazole 500mg) against internal parasites and sprayed against external parasites (ticks and mange). Careful observation and follow up had been undertaken for the occurrence of any ill health and disorders during the experimental period. The experimental animals were individually managed in a well-ventilated barn with concrete floor and appropriate drainage slope and gutters.

## Feed Preparation and Feeding Management

Partially dried Rhodes (*Chloris gayana*) grass hay harvested from the center's grazing field was used as a basal diet. Basal diet was offered *ad-libtum* (adjusted up to 20% refusal) in the morning hours after it was being chopped to 20-25cm in order to minimize selection. Fresh and clean water was offered all times throughout the experimental period. Formulated dairy concentrate purchased from Alema Koudijs was weighed and offered twice a day (8:00 AM and 6:00 PM) during milking times in a separate trough to that of the basal diet. Feed refusals were collected and weighed before the next feeding. Samples of feed offer and refusals were separately taken and bulked over 75 days for feed intake analysis. Feed intake was calculated as the difference of the quantity of feed offered and feed refused.

## Experimental Design and Treatments

### Treatments

Cows within a block were randomly assigned to a control and intervention diets that consisted three levels of concentrate supplementation offered during milking times. All cows were allowed free access to Rhodes grass hay as a basal feed while concentrate (treatment) was offered in the milking parlor individually according to the treatment. Cows in $T_1$ relied on basal diet plus 0.5Kg of concentrate, whereas cows under treatment II, III and IV received *ad libitum* Rhodes grass hay plus 2kg, 3kg and 4kg concentrate/day, respectively. During the experimental period, 0.5kg concentrate was provided to every cow including control group per liter of milk.

### Experimental design

Each dietary treatment was randomly assigned to four cows arranged in Randomized Complete Block Design (RCBD). Early lactating cows with an average initial milk yield of 0.98± 0.23kg/cow/day, similar body weight and conditions were selected from the total lactating dairy herd available in the center. Sixteen cows of two to five parities were selected where four animals of same parity were assigned in one block. The experimental period was 90 days out of which 15 days were used for acclimatization.

## Experimental measurements

Feed offered to the experimental animals and analogous refusals were recorded daily throughout the experimental period to determine daily feed intake. Throughout the experimental period, samples of feed offered and refusals were collected from each cow on daily basis. At the end of experimental period sub-samples were analyzed at laboratory. Feed intake was calculated as the difference between the quantity of feed offered and feed refused from each animal per day.

Milk yield from each cow was measured by using graduated measuring cylinder and then recorded on the datasheet. Lactating cows of each group were manually milked twice a day at 8:00AM and 6:00PM. Milk consumed by the calves was calculated as the difference of calves' weight gained before and after suckling.

Representative Samples (100 ml) of milk was collected for analyzing milk chemical compositions using clean and air /sun dried special plastic bottle kept in ice box and then transported to Holleta dairy laboratory to determine percentage of fat, solid not fat (SNF), total protein, total solid, and ash and lactose (AOAC, 1990).The following simple arithmetic's were used to calculate the different chemical entities of milk.

*Percent protein* = *Burette reading x* 1.74(Foley *et al*., 1974)

$$\text{Total solids} = \frac{\text{Crucible weight} + \text{oven dry sample weight} - \text{Crucible weight}}{\text{Sample weight}} \times 100$$ (O'Connor, 1994)

SNF = (TS − fat) x 100(O'Mahoney, 1988)

$$\text{Percent ash} = \frac{\text{Weight of residue}}{\text{Weight of sample}} \times 100$$ (Richardson, 1985)

Percent lactose =Percent total solids-(% fat+ % protein+ % total ash) (O'Mahoney, 1988)

Weight of the experimental animals was taken at the commencement of the experiment in the morning after overnight fasting. Its measurements were taken using heart girth measurements. Thereafter, the body weights were recorded on a weekly basis. The reading of heart girth (as an indirect estimation of body weight) was converted to kg using the regression equation (Addisu, 2010). Body weight in (Kg) = 2.126*heart girth (cm) - 87.39.

### Laboratory Feed Analysis

Chemical analysis of the feed samples was undertaken at Holeta Agricultural Research Center, Animal Nutrition Laboratory. The samples were dried in an oven at $105^0$C overnight in a forced draft oven to determine the DM contents of the feed. The other parts of feed samples were partially dried at $65^o$C and ground to pass through 1mm screen size for chemical analysis. Neutral Detergent Fiber (NDF), Acid Detergent Fiber (ADF) and Acid Detergent Lignin (ADL) were determined following the procedures of Van Soest and Roberson (1985). The ash and Nitrogen (N) content was analyzed according to procedures that outlined by AOAC (1990).

### Statistical analyses

Results of milk yield, live weight gain, feed dry matter and nutrient intake were analyzed using the General Linear Model (GLM) procedure in (SAS, 2008). Treatment means were separated using Duncan New multiple range test (Steel and Torrie 1980).

The model used for the study was: $Y_{ij} = \mu + \tau_i + \beta_j + \varepsilon_{ij}$ i = 1....4; j = 1....4
Where: $Y_{ij}$= measured variables; $\mu$ = the overall mean; $\tau_i$= the effect of $i^{th}$ treatment
$\beta_j$= the fixed effect of $j^{th}$ block; $\varepsilon_{ij}$= random error

## Results and Discussions

### Feed chemical composition

The results on feed chemical composition are presented in table1. Accordingly mean dry matter (DM) content of formulated concentrate and Rhodes grass hay contents were 91.09% and 92.27%, respectively. The dry matter (DM) content of formulated concentrate feed is lower than the result (92.02%) reported by Dereje and Temesgen (2016). The dry matter (DM) content of Rhodes grass hay in the current study agrees with the mean dry matter (DM) content 91.71% reported by Diribe *et al*. (2016) at the same study site. The CP (crude protein) content of formulated concentrate feed was 18.20%. This result is relatively comparable with the value (17.79%) reported by Dereje and Temesgen (2016). The crude protein (CP) content of Rhodes grass hay (basal feed) used in this study is comparable with the result 7%and 7.08% reported by Adugna (2008) and Dereje and Temesgen (2016), respectively. However, in comparison to the crude protein (CP) contents (7.49%) reported by Belay *et.al* (2014), the result of the current study exhibited lower crude protein (CP) contents. Crude protein (CP) content of Rhodes grass hay used as a basal diet in the current study was in the range of minimum requirement level of crude protein (CP) content of grass species suggested by McDonald *et al*. (2002) for optimal rumen functioning and microbial activity which was 7-8% of animals. The NDF content of formulated concentrate feed and Rhodes grass hay were 36.95% and (74.89%), respectively. The result of neutral detergent fiber (NDF) content of formulated concentrate feed in this study is comparable with the neutral detergent fiber (NDF) value 36.45% reported by Dereje and Temesgen (2016). The neutral detergent fiber (NDF) content of Rhodes grass hay was higher than the value (70.22%) reported by Diribe *et al*. (2016) on the same site and lower than the value (80.8 %) reported by Belay *et al.* (2014) at Hawassa College of Agriculture in Ethiopia. This difference in neutral detergent fiber (NDF) content might be attributed to the difference in stage of maturity at the harvest, type of soil, seasonal variation and the difference in management during conservation of Rhodes grass for hay.

Table 1. Mean chemical composition (% DM) of experimental feeds

| Sample feeds | DM% | Ash | CP | NDF | ADF | ADL |
|---|---|---|---|---|---|---|
| Formulated concentrate | 91.09 | 9.10 | 18.20 | 31.45 | 11.22 | 2.91 |
| RGH | 92.27 | 7.74 | 7.10 | 74.89 | 47.42 | 9.32 |
| Refusal | | | | | | |
| RGH T1 | 95.74 | 5.87 | 1.78 | 80.74 | 51.04 | 9.54 |
| RGH T2 | 96.56 | 5.94 | 1.65 | 81.14 | 48.84 | 9.64 |
| RGH T3 | 93.84 | 5.52 | 1.56 | 76.14 | 50.74 | 11.84 |
| RGH T4 | 94.87 | 5.70 | 1.62 | 76.34 | 50.94 | 10.94 |

ADF = acid detergent fiber; ADL = acid detergent lignin; CP = crude protein; DM = dry matter; NDF = neutral detergent fiber; RGH=Rhodes grass hay;T1 = RGH *adlibtum*+ 0.5Kg of concentrate; T2 = RGH *adlibtum*+ 2kg of concentrate; T3 = RGH *adlibtum*+ 3Kg of concentrate; T4= RGH *adlibtum*+ 4Kg of concentrate

## Feed dry matter and nutrient intake

The overall mean feed dry matter and nutrient intakes of cows are presented in Table 2. Dry matter intake significantly varied ($p<0.001$) among dietary treaments. Lowest DM intake (4.75 kg DM/day= $P<0.05$) was recorded in cows supplemented with the lowest level of concentrate (T1) than cows maintained on the highest level of formulate concentrate supplementations (T2, T3 and T4). Highest value of dry matter intake (DMI) with increasing level of concentrate feed in present experiment is in line with the finding of Steinshamn (2010) and Radia *et al*. (2013) who have indicated animals fed on feeds with better protein content could have better intake than those fed on grass feed alone. The variation in dry matter intake (DMI) of cows in this study might be attributed to the differences in the crude protein content of the supplemental feeds that tended to has increased with levels of concentrate in the dietary treatments. The low dry matter intake (DMI) recorded in cows supplemented with T1 might be attributed to the higher neutral detergent fiber (NDF) content of Rhodes grass hay and lower proportion of concentrate that in turn negatively associated with intake (Arelovich *et al.*, 2008). Crude protein intake has followed same trend as for dry matter intake with considerably higher intake (P<0.001) being recorded for cows receiving higher levels of concentrate supplementations (T3) followed by those cows maintained on T4. The highest crude protein intake exhibited in $T_4$ might be attributed to both the total feed intake and crude protein content of the concentrate feeds (Radia *et al*., 2013). Neutral detergent fiber and acid detergent fiber intakes were significantly different (P<0.001) among the treatment groups. Cows maintained on T1 had the lowest NDF intake than those cows maintained on T2, T3, and T4. Lowest neutral detergent fiber (NDF) intake recorded in cows supplemented with T1 might attributed to the lowest total dry matter intake (DMI) recorded in cows maintained on T1 which in turn associated with the high neutral detergent fiber (NDF) content of natural Rhodes grass hay (Radia *et al*., 2013).

Table 2. Mean dry matter and nutrient intake (kg DM/day) of Horro cows fed on different level concentrate

| Variable | TDMI | TCPI | TNDFI | TADFI | TADLI | TOMI |
|---|---|---|---|---|---|---|
| 1 | $4.75^{c}$ | $0.67^{d}$ | $3.52^{d}$ | $1.88^{c}$ | $0.40^{d}$ | $3.66^{c}$ |
| T2 | $5.71^{b}$ | $0.76^{c}$ | $4.39^{c}$ | $1.89^{c}$ | $1.03^{c}$ | $4.61^{b}$ |
| T3 | $6.67^{a}$ | $0.79^{b}$ | $5.39^{b}$ | $2.54^{b}$ | $2.06^{b}$ | $5.61^{a}$ |
| T4 | $6.79^{a}$ | $0.88^{a}$ | $5.67^{a}$ | $2.74^{a}$ | $2.27^{a}$ | $5.71^{a}$ |
| Overall mean | 5.98 | 0.78 | 4.74 | 2.26 | 1.44 | 4.89 |
| SE | 0.21 | 0.02 | 0.22 | 0.10 | 0.19 | 0.21 |
| CV | 1.43 | 0.781 | 2.35 | 4.20 | 1.04 | 1.89 |
| (p-level) | *** | *** | *** | *** | *** | *** |

$^{abc}$Means within the same column with different superscripts are significantly different at * = (P < 0.05); ** = (P < 0.01); *** = (P < 0.001); TDMI = total dry matter intake; TCPI = total crude protein intake; TNDFI = total neutral detergent fiber intake; TADFI = total acid detergent fiber intake; TOMI= total organic matter intake; T1 = RGH *adlibtum*+ 0.5Kg of concentrate; T2 = RGH *adlibtum*+ 2kg of concentrate; T3 = RGH *adlibtum*+ 3Kg of concentrate; T4= RGH *adlibtum*+ 4Kg of concentrate

## Milk yield

The overall mean milk yields of cows are presented in Table 3. Mean milk yield was noticeably significant at (P<0.001) among treatment groups. Thus, cows that were receiving dietary T4 produced same milk as cows on dietary T3 daily but compared those cows maintained on T1 and T2 produced markedly higher daily milk yield (P<0.05). The overall mean milk yield observed in the current study was (3.12± 0.46 kg/day) which is higher than the previous reports 2.38Kg/day and 2.96kg/day by Dereje and Temesgen, (2016) and Diribe *et al.*(2016) for Horro cows respectively, and 2.34Kg/day by Lemma and Endalew (2017) for Fogera cows. The variation might be due to the experimental feed (commercial dairy concentrate) used in this study and difference in milk production potentials existing among local cattle breed types available in the country. The present result is in line with the report by Khalili and Sairanen (2000), and Diribe *et al.* (2016) who indicated that supplemented cows produce pointedly more milk than those relying on natural pasture alone. The difference in milk yield among treatments set could be attributed to the differences in level of concentrate that in turn increase the intake of energy by animals consuming different levels (amounts) of concentrate and pronounced variation among dry matter intake of cows.

Table 3. Mean milk yield (kg/Day) of Horro cows fed on different level concentrate

| Treatment | Milk yield |
|---|---|
| T1 | 2.62[c] |
| T2 | 3.02[bc] |
| T3 | 3.27[ab] |
| T4 | 3.55[a] |
| Overall Mean | 3.12 |
| SE | 0.16 |
| CV | 8.73 |
| (p-level) | *** |

[abc]Means within the same column with different superscripts are significantly different at
* = (P < 0.05); ** = (P < 0.01); *** = (P < 0.001); T1 = RGH *adlibtum*+ 0.5Kg of concentrate;
T2 = RGH *adlibtum*+ 2kg of concentrate; T3 = RGH *adlibtum*+ 3Kg of concentrate;
T4= RGH *adlibtum*+ 4Kg of concentrate

## Milk chemical composition

The overall mean for CP, fat, total solids, solid-no-fat, ash and lactose contents is presented in Table 4. All the milk compositions analyzed were significantly different (p<0.05) among treatment groups except lactose content. The overall mean fat content (3.48±0.14%) was significantly higher for T1 and T2 at (p<0.05) than cows fed on T3 and T4. The highest result of fat content exhibited on T1 is in line with the report of Khalili and Sairanen (2000) who have indicated higher milk fat content of cows allocated only green hay. Lowest result of fat content (2.95%) recorded for T4 might be attributed to increased level of concentrate supplementation in the diet. The CP content was significantly different (P<0.05) among the treatments. Milk from cows supplemented with T4, had the highest protein content of milk from cows fed on $T_1$ $T_2$ and T3 diets. The differences in CP contents of milk for this study might result from the difference in the proportion of volatile fatty acids in the rumen that could be obtained from experimental feed. *i.e* concentrate feed which believed to increase proportion of propionic acid and in turn boosts protein contents of milk for dairy animals (McDonald *et al.,* 1995). The total solid (TS), solid-not-fat (SNF) and ash contents of milk were significantly different (P<0.05) among treatments.

Cows maintained on T1 had lowest results of total solid (12.04%) and solid not fat (9.09%) than cows maintained on T2, T3 and T4. Highest total solid (14.44%) content was recorded for T4. This result is comparable with total solid content (14.23%) reported by Radia *et al.* (2013). Lowest result of solid not fat exhibited in T1 might attributed to concept which stated that the solid-not-fat content can fall if the cow is fed a low energy diet, however it is not greatly influenced by protein deficiency, unless the deficiency is acute (O'Connor, 1994).

Table 4. Mean rate of milk composition of Horro cows fed on different level concentrate Horro cows fed on different level of concentrates

| Treatments | Milk Chemical Composition (%) | | | | | |
|---|---|---|---|---|---|---|
| | CP | Fat | TS | SNF | Ash | Lactose |
| T1 | 2.60[c] | 4.03[a] | 12.04[c] | 9.09[b] | 0.66[c] | 5.82[a] |
| T2 | 3.36[b] | 3.70[b] | 13.08[b] | 9.85[ab] | 0.71[c] | 5.78[a] |
| T3 | 3.62[b] | 3.23[c] | 13.92[ab] | 10.22[a] | 0.77[b] | 5.83[a] |
| T4 | 4.05[a] | 2.95[d] | 14.44[a] | 10.40[a] | 0.87[a] | 5.48[a] |
| Overall Mean | 3.41 | 3.48 | 13.37 | 9.89 | 0.75 | 5.73 |
| SE | 0.17 | 0.14 | 0.27 | 0.23 | 0.03 | 0.13 |
| CV | 6.38 | 4.56 | 0.58 | 6.52 | 3.83 | 8.34 |
| (p-level) | *** | *** | *** | ** | *** | NS |

[abc]Means within the same column with different superscripts are significantly different at * = (P < 0.05); ** = (P < 0.01); *** = (P < 0.001); NS= not significant at (P<0.05); CP= crude protein; TS= total solid; SNF= solid-not-fat; T1 = RGH adlibtum + 0.5Kg of concentrate; T2 = RGH adlibtum + 2kg of concentrate; T3 = RGH adlibtum + 3Kg of concentrate; T4= RGH adlibtum + 4Kg of concentrate

## Body weight Change

The overall mean initial body weight and final body weight is presented in Table 5. The average initial and final live weights of lactating cows prior to the trial and at the end of experiment were 201.68±0.58kg and 206.05±0.62kg, respectively. Initial body weight was not significantly different among treatment groups. Final body weight among treatments of cows fed T4 was significantly (P<0.05) higher than T1. The higher body weight gain recorded for T4 was due to the higher concentrate nutrient intakes. The result of final body weight change in the current finding is in line with the finding reported by Aston *et al*. (2005) who indicated live weight gain of milking cows can be increased with higher concentrate supplementation. The other reason for final body weight change might be good body condition of cows prior to an experiment which in line with finding of Weber *et al* (2013) who indicated body condition of cow before parturition had significant effects on body weight change during early lactation.

Table 5. Mean body weight change of Horro cows fed on different level concentrate

| Treatments | Body weight(kg) | |
|---|---|---|
| | Mean initial Body weight | Mean final Body weight |
| T1 | 200.01[a] | 204.30[b] |
| T2 | 201.06[a] | 205.06[ab] |
| T3 | 202.65[a] | 206.89[ab] |
| T4 | 203.01[a] | 207.94[a] |
| Overall Mean | 201.68 | 206.05 |
| SE | 0.58 | 0.62 |
| CV | 1.02 | 0.98 |
| (p-level) | NS | NS |

[abc]*Means within the same column with different superscripts are significantly different at * = (P < 0.05); ** = (P < 0.01); *** = (P < 0.001); NS= not significant at (P<0.05); T1 = RGH adlibtum + 0.5Kg of concentrate; T2 = RGH adlibtum + 2kg of concentrate; T3 = RGH adlibtum + 3Kg of concentrate; T4= RGH adlibtum + 4Kg of concentrate*

## Conclusions

In general, the supplementation of early lactating Horro cows with Rhodes grass hay plus 4kg of formulated concentrate feed had improved their performance on feed intake, milk yield and composition and final body weight change. But profitability of supplementing different level of formulated concentrate to early lactating Horro cows was not evaluated in the current study. It is therefore necessary to validate the significance of this study at farmer's level by conducting on-farm trials. Consequence of supplementing with such experimental feed over successive lactation period viz: mid and late stage of lactation also need to be evaluated.

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