ONLINE JOURNAL OF ANIMAL AND FEED RESEARCH

An International Peer-Reviewed Journal which Publishes in Electronic Format

Volume 8, Issue 2, March 2018

Online J. Anim. Feed Res., 8 (2): March 25, 2018

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Volume 8 (2); 25 March 2018

Abstract

The aim of this study was to determine the protein and amino acid digestibilities, and apparent metabolizable energy (AME) contents of sorghum-barley brewers' spent grain (SBBSG), use this information to formulate an appropriate diet for broilers, and determine the effect of SBBSG inclusion on growth, carcass and blood parameters. In experiment one fifteen individually housed broilers were used to determine the apparent digestibilities of nutrients. Another cohort of 15 broilers were raised alongside and nutrient digestibility of key nutrients in wheat bran determined. The AME of SBBSG (6.72 MJ/kg) was higher than previously assumed, whereas the digestibility values of some of the essential amino acids for SBBSG (Lys, Met, Phe, Thr and Val) were generally lower (42.93, 71.6, 55.47, 75.26, and 62.66%) than previously assumed. In experiment two, diets were formulated based on nutrient availability values from trial one and fed to two hundred and fifty day-old chicks. Birds were allotted to five diets (TI, T2, T3, T4 and T5, representing 0, 4, 8 12 and 16% SBBSG, respectively). Average daily feed intake (ADFI) for birds on T1 and T2 were similar (105.6 and 102.3g) and these were higher ($P < 0.05$) than ADFI for birds on T3 to T5 (92.2, 93.4 and 88.3 respectively). There were no treatment differences in average daily gain (ADG) and final body weight (FNBW). However as the level of dietary SBBSG increased, feed conversion efficiency (FCE) improved. Carcass parameters were not affected by the level of dietary SBBSG. Blood parameters were within acceptable ranges for broilers. It can be concluded that inclusion of SBBSG up to 16% in diets that are formulated based on nutrient availability, will have no adverse effects on broiler performance and blood profile. Results of this trial indicate that nutrient availability is key in effective feed formulation and broiler productivity.

Keywords: Sorghum-Barley Brewers' Spent Grain, Digestibility, Performance, Blood Profile

[Full text-PDF] [XML]

Abstract

Assessment was partially done as per the syllabus prepared by Sustainable Resources Management Program of North Gondar Zone (SRMP-NG) financed by Austrian Government. The assessment was conducted in six randomly selected districts of North Gondar zone in the year 2015. The objectives of the study were; to assess and estimate the existing agro-industrial by-product feed for cattle and feedlot operators, to depict the feed stocks available for ration formulation and to measure industrial by-products of oil seed cakes and powdery mill (brans) in the study area. The assessment result was showed that, Gondar town was found to be the highest potential for agro-industrial by-product feed accounts about 560106 and 493436 quintal. The reason might be due to the availability of large number of feed processing factories in the town but bran could not found any other districts other than Gondar town. Grain milling factories produces bran were found in Gondar town and supplies feed to different function of animals. The other produced very minimal due to factory owners are argumentative on the current tax set by the government which, is beyond the production capacities of the factories.

Keywords: Conventional feed, Food Processing Plant, Oil Seed Cakes, Barn, Ethiopia.

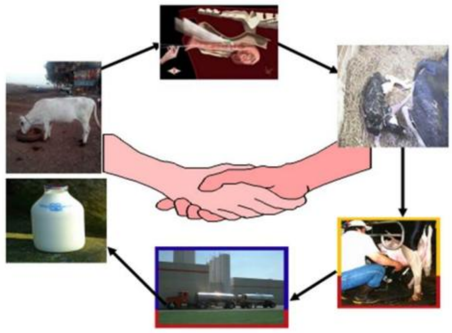
[Full text-PDF] [XML]

Research Paper

Dairy technology adoption in small holder farmer in and around Gondar town, amhara region, Ethiopia.

Chanie D, Minwagaw L, Tesfaye E and Yiblet M.

Online J. Anim. Feed Res., 8(2): 39-45, 2018; pii: S222877011800006-8



Chanie D, Minwagaw L, Tesfaye E and Yiblet M (2018). Dairy technology adoption in small holder farmer in and around Gondar town, amhara region, Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 39-45. www.ojafr.ir

Abstract

The study was conducted in and around Gondar town Zone of Amhara regional state, North Gondar, Ethiopia to assess the dairy technology adoption practice in small holder farmer. A total of 40 Households (HHs) were randomly selected. Questioner was developed and a survey was conducted on the selected HHs pertaining dairy technology and adoption practice. The gathered data was summarized and analyzed by using SPSS 20. The result revealed that 85 % of respondents do not adopt different dairy technologies.Most of the households in the study area were usingindigenous dairy cattle breeds. The proportion of cattle's owned by respondents were 4.45±2.253, 0.7±2.366 and for indigenous, Exotic and cross breed, respectively. Despite the largest concern was given for male households, females also involved in cow management, milking activities aiming for milk consumption and income generation. Almost all farmers in the study area provided house for cattle, and about 42.5 % of the respondents indicated that loose housing system is widely used in the area. Ration formulation based on scientific standard was not common in the study area. From the interviewed households, 50 % of respondents were practicing mixing of different feed stuffs which is taken as formulation. All of the households in the study area neglects urea molasses block making and silage making technologies. In general the level of technology adoption by smallholder farmers is still unsatisfactory. Therefore, the government and extension agent should give emphasis on improving dairy technology and its adoption in small holder farmer though continuous training on how to utilize improved feeding, artificial insemination, improved housing and health care technologies.

Keywords: Adoption, Dairy Cattle, Smallholder, Technology

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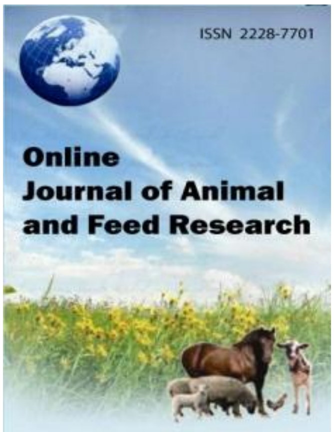

ISSN: 2228-7701

Frequency: Bimonthly

Current Issue: 2018, Vol: 8, Issue: 2 (March)

Publisher: SCIENCELINE

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2018 SCIENCELINE

Online Journal of Animal and Feed Research

Volume 8, Issue 2: 20-32; Mar 25, 2018 ISSN 2228-7701

EFFECT OF METABOLIZABLE ENERGY CONTENT AND ILEAL AMINO ACID DIGESTIBILITY OF SORGHUM-BARLEY BREWER'S SPENT GRAIN (SBBSG) ON GROWTH, CARCASS AND BLOOD PARAMETERS IN BROILERS

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ABSTRACT: The aim of this study was to determine the protein and amino acid digestibilities, and apparent metabolizable energy (AME) contents of sorghum-barley brewers' spent grain (SBBSG), use this information to formulate an appropriate diet for broilers, and determine the effect of SBBSG inclusion on growth, carcass and blood parameters. In experiment one fifteen individually housed broilers were used to determine the apparent digestibilities of nutrients. Another cohort of 15 broilers were raised alongside and nutrient digestibility of key nutrients in wheat bran determined. The AME of SBBSG (6.72 MJ/kg) was higher than previously assumed, whereas the digestibility values of some of the essential amino acids for SBBSG (Lys, Met, Phe, Thr and Val) were generally lower (42.93, 71.6, 55.47, 75.26, and 62.66%) than previously assumed. In experiment two, diets were formulated based on nutrient availability values from trial one and fed to two hundred and fifty day-old chicks. Birds were allotted to five diets (TI, T2, T3, T4 and T5, representing 0, 4, 8 12 and 16% SBBSG, respectively). Average daily feed intake (ADFI) for birds on T1 and T2 were similar (105.6 and 102.3g) and these were higher ($P<0.05$) than ADFI for birds on T3 to T5 (92.2, 93.4 and 88.3 respectively). There were no treatment differences in average daily gain (ADG) and final body weight (FNBW). However as the level of dietary SBBSG increased, feed conversion efficiency (FCE) improved. Carcass parameters were not affected by the level of dietary SBBSG. Blood parameters were within acceptable ranges for broilers. It can be concluded that inclusion of SBBSG up to 16% in diets that are formulated based on nutrient availability, will have no adverse effects on broiler performance and blood profile. Results of this trial indicate that nutrient availability is key in effective feed formulation and broiler productivity.

ORIGINAL ARTICLE
pii: S222877011800004-8
Received 07 Jan. 2018
Accepted 10 Mar. 2018

Keywords: Sorghum-Barley Brewers' Spent Grain, Digestibility, Performance, Blood Profile

INTRODUCTION

The broiler industry in Ghana faces severe challenges and its growth continues to be slow. Providing adequate and affordable nutrition for poultry and livestock poses a challenge to livestock production in developing countries like Ghana (FAO, 2011). The development of the poultry industry depends to a large extent on the availability of feedstuffs that are used or can be made suitable for use in poultry nutrition (Ondwasy et al., 2006). Feed costs alone can constitute up to about 70% of the total cost of production of poultry meat and eggs (Babiker et al., 2009). Feed prices in Ghana have been climbing primarily due to the fact that grains used in animal feed formulation, are the same grains that are used in human diets and in the breweries as well. The United States Department of Agriculture (USDA) estimates that in Ghana, the poultry industry consumes nearly 30 percent of all corn produced (USDA, 2013). The competition and consequently, increase in the cost of feed and animal production (FAO, 2011) necessitates a reduction in the use of whole grain and cereals in monogastric diets with increasing emphasis on the

To cite this paper: Nortey Th-N-N, Frimpong R and Naazie A (2018). Effect of metabolizable energy content and ileal amino acid digestibility of sorghum-barley brewer's spent grain on growth, carcass and blood parameters in broilers. *Online J. Anim. Feed Res.*, 8(2): 20-32. www.ojafr.ir

use of cereal and Agro-Industrial by-products. Nutrients in these by-products must be packaged in such a way that they can support monogastric production. Spent grain from the brewing industry is a typical example of such an ingredient.

The brewing industry in Ghana generates large quantities of brewer's spent grain. The composition of this by-product depends on the grain used in the brewing process. Generally however they tend to be high in some essential nutrients (including protein and essential amino acids and fats; Mussatto et al., 2006) but have somewhat limited use in monogastric diets because of high fibre levels (Nortey et al., 2013; Manu-Barfo et al., 2013). Some of the larger breweries in Ghana use malted Sorghum as starting grains for their brewing operations. The resulting spent grain, Sorghum-Barley Brewer's Spent Grain (SBBSG), is unique and is used mainly by swine producers in the Kumasi Metropolis of Ghana as part of a wet-feeding regimen. Initial trials indicated that broilers fed SBBSG-based diets had improved growth rate, but the composition of this grain was mainly fat. Although the chemical composition of SBBSG, particularly amino acids, was determined and found to be high, its digestibility and availability to broilers was not determined (Nortey et al., 2013). As a result of this, in the above mentioned trials, digestibility values for brewers spent grain reported by Donkor and Attoh- Kotoku (2009) were used in the formulation of SBBSG based diets. Differences in digestibility values for different ingredients are important, as formulating diets on the basis of total nutrients rather than on digestible nutrients, resulting in wrong amino acid to Energy ratios, can result in excessive fat deposition (Jackson et al., 1982). According to the National Research Council (NRC), availability of nutrients in different feed ingredients and ultimately in compounded feed is essential for the optimal production of birds (NRC, 2000). Information on the ability of a ration to supply digestible rather than total nutrients is necessary for accurate diet formulation (Ravindran, 2013).

Digestibility of poultry diets is very important and can be a limiting factor governing energy and nutrient availability (Adedokun et al., 2007). Digestibility of nutrients present in a feed ingredient therefore needs to be quantified. However, there is no information on nutrient digestibility of SBBSG in poultry. The hypothesis of this study therefore was that, when diets are formulated based on available, rather than on total amino acid and energy availability, SBBSG can be included in diets for broilers without negatively affecting growth, carcass composition and the health of birds.

The specific objectives of the present study were: I) to determine the AME and ileal digestibilities of amino acids in SBBSG, II) use the results obtained to formulate appropriate diets for broiler birds, and III) determine the digestibility of a comparable high-fibre ingredient (wheat bran). Results of the third objective were then compared to literature values and was intended to serve as a validation for the results obtained for the SBBSG digestibility values.

MATERIALS AND METHODS

The animal protocol used followed principles and ethical procedures recommended by the Institutional Animal Care and Use Committee of the Noguchi Memorial Institute for Medical Research, University of Ghana. The experiments were conducted in two phases. The first phase consisted of a digestibility trial and the second phase was a feeding trial. The two experiments were carried out at the Livestock and Poultry Research Centre (LIPREC), College of Basic and Applied Sciences (CBAS) of the University of Ghana (UG). Digestibility values obtained in the first experiment were used to formulate appropriate diets containing varying levels of SBBSG for a growth trial. The growth performance and carcass characteristics of broiler chickens fed these diets were then evaluated.

The proximate chemical analysis of the feed ingredients and the compounded feed were done at the Nutrition Laboratory at the Department of Animal Science (DAS), CBAS- UG. Amino acid analysis was done at the Animal Science Department of the University of Illinois, United States of America. The analysis for protein and energy in the illeal digesta and the faecal samples of the individual birds were done at the Nutrition Laboratories of the Department of Animal Science (DAS), CBAS- UG and the Livestock and Poultry Research Centre (LIPREC).

Feed Ingredients

The SBBSG was obtained from the Kaase plant of Guiness Ghana Brewery Limited (GGBL) in Kumasi, Ghana. Fresh material with an approximate moisture content of 95% was sun-dried for one week to a moisture content of 6%, ground through a hammer mill with a screen size of approximately 2mm, and stored until ready for use. The wheat bran was obtained from a local flour mill that sells this particular by-product on the open market to farmers.

Animals and housing

One hundred mixed sex COBB day-old broiler chicks were used as the starting point out of which 30 were used for digestibility trials. They were initially placed in deep litter pens and fed a commercial broiler starter diet

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from day one to day 21. On day 22 the birds were transferred to individual battery cages measuring 42 x 35 x 42 cm (L x B x H) where they were fed a broiler finisher diet till d 35.

Determination of apparent metabolizable energy in SBBSG and wheat bran

On d 36, an initial group of 30 individually housed broilers were used for the determination of apparent metabolizable energy contents in SBBSG and wheat bran (15 birds per ingredient). Birds were fed *ad libitum* on a broiler finisher diet for 1 week prior to force-feeding (Sibbald, 1986). Collection trays were fixed to the individual cages, the birds were fasted for 24 h and force-fed 60 g of the test ingredient. Excreta were collected daily from each bird for 48 h and the samples immediately placed on ice to help prevent microbes from multiplying. The samples were then freeze dried at a temperature of -18°C for 70h. Excreta samples were blended, ground through a 0.75 mm sieve (Ultra-centrifugal mill ZM 200, Retsch GmbH & Co. KG, Haan, Germany) and stored in plastic bags until analyses. Both the test ingredients and faecal materials were subsequently analysed for gross energy by a bomb calorimeter.

Determination of apparent ileal amino acid and nitrogen digestibility in SBBSG and wheat bran

Out of the remaining 70 birds that remained from the initial group, 30 male broilers (15 per test ingredient) of approximately equal weight were selected and used to determine apparent ileal and amino acid digestibilities. The test ingredients, SBBSG and wheat bran were mixed with minerals and a vitamin premix. Chromic acid (an indigestible marker) was incorporated into the diets at a level of 0.3% (Table 1). The birds were fed the test diets *ad lib* from day 35 for seven days. On day 42, the birds were euthanized by cervical dislocation and the gastro-intestinal-tract removed. The contents of the terminal ileum (half-way between the ileal-cecal junction and Meckel's diverticulum) were emptied by dissecting this region and collecting the digesta by gentle finger-stripping and flushing with 10 -15 mls of distilled/deionized water into a plastic bag following the method of Ravindran (2007).

The bags containing the 30 individual samples (15 per test ingredient) were immediately placed on ice, transported and freeze-dried. The freeze-dried samples were then allowed to equilibrate to room temperature, ground through a 0.75 mm sieve (Ultra-centrifugal mill ZM 200, Retsch GmbH & Co. KG, Haan, Germany) and stored at room temperature in a dry place prior to chemical analyses. Digesta samples were blended, and stored in plastic bags at 30ºC until analysis for the major nutrients (protein, amino acids and energy). Digestibility of wheat bran was also conducted and the results compared to literature values. This was to serve as a validation for the results obtained for the SBBSG digestibility values.

Growth Performance and Carcass Parameters

Animals, Housing and Diets. A total of 250 mixed-sex Ross broiler day-old chicks were randomly allocated to five treatments, replicated five times with 10 birds per replicate in a Completely Randomized Design (CRD). In the first 4 wks, birds were housed in a brooder house in pens measuring 152 x 152 cm. Thereafter, they were transferred to cages measuring 55x 39 x 49 cm. The birds were individually weighed at the start of the experiment and subsequently on a weekly basis. Birds in each replicate were given a known amount of feed daily, and any leftover feed weighed the next day prior to the day's feeding in order to determine feed intake. The leftover feed was then discarded and fresh feed provided. Water was provided ad-lib. Standard routine vaccination protocols were strictly adhered to. The birds were fed with the experimental starter diet for 28d (Table 3) after which they were switched onto the finisher diet (Table 4) for the rest of the trial. The results of the digestibility trials and chemical analysis of the feed ingredients were used as the basis for formulating the diets. Diet one (T1) had zero SBBSG, while T2, T3, T4 and T5 had 4, 8, 12 and 16% SBBSG respectively.

Table 1 - Composition of the diets used for the digestibility trial

Ingredient	SBBSG-Based diet	Wheat Bran-based diet
SBBSG	95.7	0
Wheat Bran	0	95.7
Dicalcium Phosphate	1.5	1.5
Vitamin Premix [a]	1.00	1.00
Oyster Shell	1.00	1.00
Salt	0.50	0.50
Cr_2O_3	0.3	0.3
Total	100	100

[a] Premix provided the following per kg of the diet: vit. A, 7500 IU; vit. D_3, 2200 IU; vit. E, 10 IU; vit. K, 1.73 mg; riboflavin, 2.5 g 2.5 g; cobalamin, 0.05 mg; pantothenic acid, 6 mg; niacin, 20 mg; choline, 240 mg; folic acid, 0.5 mg; Mg, 2.8 mg; Fe, 45 mg; Cu, 5.5 mg; Mn, 55 mg; Zn, 50 mg; I,0.8 mg; Co, 0.2 mg

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Table 2 - Composition of broiler starter diets used for the growth trial

Ingredients (%)	0% SBBSG*	4% SBBSG	8% SBBSG	12% SBBSG	16% SBBSG
Maize	51.50	53.50	54.50	55.50	56.50
Soybean meal	27	25.35	24.35	23.35	22.35
Wheat bran	16	12	8	4	0
SBBSG	0	4	8	12	16
Soybean oil	1	0.5	0.5	0.5	0.5
Dicalcium phosphate	0.7	0.7	0.7	0.7	0.7
Vitamin premix [a]	0.6	0.6	0.7	0.7	0.7
Methionine	0.25	0.3	0.3	0.3	0.3
Lysine	0.25	0.3	0.3	0.3	0.3
NaCl	0.25	0.25	0.25	0.25	0.25
Limestone	2.5	2.5	2.5	2.5	2.5
Total	100	100	100	100	100
Calculated analyses					
ME,MJ/kg	11.5	11.5	11.6	11.73	11.86
Crude protein (%)	21.6	21.6	21.61	21.67	21.72
Crude fat (%)	4.43	3.9	3.85	3.8	3.8
Crude fibre (%)	3.4	3.6	3.8	3.97	4.15
Lysine (%)	1.3	1.32	1.3	1.28	1.26
Methionine (%)	0.5	0.56	0.57	0.58	0.59
Calcium (%)	1.14	1.16	1.16	1.16	1.16
Phosphorus (% total)	0.7	0.64	0.62	0.59	0.57

* SBBSG: Sorghum-Barley Brewer's Spent Grain, [a]Premix provided the following per kg of the diet: vit. A, 7500 IU; vit. D_3, 2200 IU; vit. E, 10 IU; vit. K, 1.73 mg; riboflavin, 2.5 g 2.5 g; cobalamin, 0.05 mg; pantothenic acid, 6 mg; niacin, 20 mg; choline, 240 mg; folic acid, 0.5 mg; Mg, 2.8 mg; Fe, 45 mg mg; Cu, 5.5 mg; Mn, 55 mg; Zn, 50 mg; I,0.8 mg; Co, 0.2 mg

Table 3 - Composition of broiler finisher diets used for the growth trial

INGREDIENTS (%)	T1 0% SBBSG*	T2 4% SBBSG	T3 8% SBBSG	T4 12% SBBSG	T5 16% SBBSG
Maize	55.25	56.80	57.80	58.80	59.80
Soybean meal	23.7	22.05	21.05	20.05	19.05
Wheat bran	16	12	8	4	0
SBBSG	0	4	8	12	16
Soybean oil	1	0.5	0.5	0.5	0.5
Dicalcium phosphate	0.7	0.7	0.7	0.7	0.7
Vitamin premix [a]	0.6	0.6	0.6	0.6	0.6
Methionine	0.25	0.3	0.3	0.3	0.3
Lysine	0.25	0.3	0.3	0.3	0.3
NaCl	0.25	0.25	0.25	0.25	0.25
Limestone	2.5	2.5	2.5	2.5	2.5
Total	100	100	100	100	100
Calculated analyses					
ME, MJ/kg	11.56	11.59	11.72	11.85	11.98
Crude protein (%)	20.2	20.4	20.4	20.46	20.51
Crude fat (%)	4.44	3.9	3.85	3.8	3.75
Crude fibre (%)	3.4	3.58	3.76	3.94	4.11
Lysine (%)	1.21	1.24	1.22	1.20	1.18
Methionine (%)	0.5	0.55	0.56	0.57	0.57
Calcium (%)	1.15	1.15	1.15	1.15	1.15
Phosphorus (% total)	0.65	0.63	0.60	0.58	0.56

* SBBSG: Sorghum-Barley Brewer's Spent Grain; [a]Premix provided the following per kg of the diet: vit. A, 7500 IU; vit. D_3, 2200 IU; vit. E, 10 IU; vit. K, 1.73 mg; riboflavin, 2.5 g 2.5 g; cobalamin, 0.05 mg; pantothenic acid, 6 mg; niacin, 20 mg; choline, 240 mg; folic acid, 0.5 mg; Mg, 2.8 mg; Fe, 45 mg mg; Cu, 5.5 mg; Mn, 55 mg; Zn, 50 mg; I,0.8 mg; Co, 0.2 mg

Chemical Analyses

All major feed ingredients and experimental diets were ground to pass through a 1mm sieve in a hammer mill (Retsch SM100, F.Kurt GmgH Co). Samples for analysis were weighed using a top- loading electronic balance (ADAM AAA 250LE). Dry matter was determined overnight at 105ºC in a Gallenkamp oven (method 930.15; AOAC, 2000). Crude protein analysis was done using the Kjedahl method (method 942.05; AOAC, 2000). Samples were digested at 400ºC for 3hours with the Gerhardt Kjeldatherm (Germany) digester; distillation and titration were done using the Gerhardt Vapodest 50s (Germany) distillation unit. Amino acid analysis was carried out using ion-

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exchange chromatography, following standard procedures (AOAC, 2000). First, the protein was hydrolyzed, followed by separation, identification, and finally quantification of the amino acids. The procedure involved sample hydrolysis in a 6 N HCl for 24 h at 110 °C under N atmosphere. For sulphur containing amino acids (methionine and cysteine), the performic acid oxidation was first carried out before acid hydrolysis. This step is to convert cysteine to cysteic acid and methionine to methionine sulfone, which are acid stable and can then be separated by chromatographic methods. Samples for tryptophan analysis were hydrolyzed using barium or sodium hydroxide to avoid the destruction of tryptophan by acid hydrolysis and to enhance its stability. The amino acids in the hydrolysate were then determined by HPLC after post-column derivatization (AOAC, 2000; 982.30 E). The chromic oxide concentration in feed, faeces and digesta were determined using the method described by Fenton and Fenton (1979).

The whole trial lasted 56d. Performance and feeding records were taken and summarized on a weekly basis. These included average daily feed intake (ADFI), average daily gain (ADG) and feed conversion efficiency (FCE). On day 56, the final body weights (FBW) were taken and five birds per replicate were randomly selected. Blood from each bird was quickly drawn from the wing vein using a 10ml syringe. About 3ml was transferred into a 4ml sample tube (Surgifield Medicals, Middlessex, England) using K_3 EDTA as an anticoagulant. For serum profiling, about 3ml of blood was transferred into a 5ml serum-separator vacuum tube. Both samples were analysed within one hour of collection for haematological and biochemical parameters using an Advia 120 analyzer.

The remaining 5 birds from each replicate were slaughtered by jugular venipuncture (Osei et al., 2010). They were de-feathered after scalding in boiling water and immediately transferred into a cold room where they were stored overnight at -4^{0}C. The next day, the whole chilled carcasses were weighed. Weights of some internal organs (including liver, full and empty intestines, and gizzard) were taken. Abdominal fat which had solidified following the overnight chilling was carefully separated and the weight recorded.

Data analysis

Estimates of apparent nitrogen and amino acid digestibilities were determined using ileal samples and calculated from the dietary ratio of protein or amino acids to chromium relative to the corresponding ratio in the ileal digesta. Apparent metabolizable energy was determined according to the method used by Donkor and Attoh-Kotoku (2009). The formula used was as follows:

AME = (EI – EO)/FI

Where

EI = Gross energy in feed

EO = Gross energy in faeces

FI = Feed Intake (90 g, in this case)

Nutrient digestibility was calculated using the formula below;

$$\text{Digestibility\%} = \frac{100 - \{(\text{Concentration } (CrO_3) \text{ in feed} \times \text{concentration (Nutrient) in digesta})\} \times 100}{(\text{Concentration } (CrO_3) \text{ in digesta} \times \text{concentration (Nutrient) in feed})}$$

Statistical analyses

All data collected were subjected to statistical analysis using the Generalized Linear Model (GLM) Procedure of Statistical Analysis System Institute (SAS, 2003). Significant differences among treatment means were separated using the Student Neuman-Keuls' (SNK) Test.

The model used was as follows;

$Y_{ij} = \mu + D_i + E_{ij}$

Where,

Y_{ij} is the observation

μ is the mean

D_i is the effect of diet

E_{ij} is the error term

RESULTS

Nutrient composition

The analyzed nutrient composition of the SBBSG and wheat bran are shown in Table 4. Crude protein, crude fat, and organic matter (OM) levels were higher in SBBSG (26.95, 7.85 and 75.76%) than in WB (16.61, 3.55 and 70.88%). Essential amino acids (Lys, Met and Thr), and Crude fat levels were also higher in SBBSG (0.77, 0.44, 0.90 and 8.85% than in wheat bran were (0.66, 0.20, 0.50 and 3.55%). Generally there were wide variations between

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some amino acid digestibilities in SBBSG. For the essential amino acids Lys, Thr, Met, Cys, Phe and Leu, apparent digestibilities were higher in Thr for SBBSG (42.93, 75.26, 71.58, 53.91, 55.47 and 55.9%) but similar or lower for the rest of them in WB (69.5, 67.2, 70.9, 70.8, 78.55 and 69.63%).

Nutrient digestibilities

The apparent amino acid digestibilities of the SBBSG and wheat bran are shown in Table 5.

Growth performance

Growth traits of interest that were recorded included ADFI, ADG, FCE and FNBW (Table 6).

Average daily feed intake

Generally as the dietary level of SBBSG increased, ADFI reduced. For T1 and T2, ADFI was 105.59 and 102.30 g respectively. These values were different (P<0.05) from birds on T3 and T4 (92.92 and 93.35g) respectively. Birds on T5 consumed the least amount of feed (88.26g) and this was lower (P<0.05) than all the other treatments.

Average daily gain, feed conversion efficiency and final body weight

There was no dietary effect (P>0.05) on the average daily gain of birds. As the level of SBBSG increased in the diet, FCE tended to improve. Feed conversion efficiency for birds on T5 (0.55 g/bird/day) was similar (P>0.05) to FCE of birds on T3 and T4 (0.52 and 0.52 g/bird/day respectively) but better (P<0.05) than FCE of birds on T1 and T2 (0.50 and 0.50 g/bird/day respectively). Final body weight was not affected by treatment.

Carcass parameters

There were no significant differences (P> 0.05) between all the carcass parameters measured as shown in Table 7.

Blood parameters

Hematological parameters. Table 8 shows the effect of diet on some blood hematological parameters. There was no dietary influence on any of the blood parameters

Biochemical parameters. Table 9 shows the effect of diet on some blood biochemical parameters. With the exception of alkaline phosphatase (ALP), gamma-glutamyl transpeptidase (GGT) and glucose where there were differences among treatments (P <0.05), all the other blood biochemical parameters were not affected by diet.

Table 4 - Analyzed nutrient composition of SBBSG *and Wheat Bran

Item	SBBSG*	Wheat Bran
GE, kcal/kg	3,855	3,389
DM, %	84.37	89.55
CP, %	26.95	16.61
Ash, %	8.61	8.67
Crude fat, %	8.85	3.55
Crude fibre, %	14.75	9.2
OM[1], %	75.76	70.88
P, %	0.90	1.32
Ca, %	0.86	0.60
Amino acids, %		
Arg	0.91	0.98
His	0.49	0.37
Ile	1.02	0.51
Leu	2.79	0.96
Lys	0.77	0.66
Met	0.44	0.20
Phe	1.33	0.57
Thr	0.90	0.50
Trp	0.10	0.12
Val	1.26	0.76
Ala	1.90	0.84
Asp	1.75	1.12
Cys	0.44	0.38
Glu	4.35	3.12
Gly	0.91	0.85
Pro	1.92	0.76
Ser	1.03	0.66
Tyr	0.79	0.46

*Sorghum-Barley Brewer's spent Grain; [1] Organic matter

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Table 5 - Apparent metabolizable energy (MJ/kg) and ileal crude protein and amino acid digestibilities (%) in SBBSG and WB

Item	SBBSG*	Wheat Bran
AME	7.22	6.01
Crude protein	73.57	73.55
Calcium	60.45	59.75
phosphorous	45.40	35.87
Arginine	79.66	78.30
Histidine	64.24	71.22
Iso Leucine	64.72	75.47
Leucine	55.9	69.63
Lysine	42.93	69.50
Methionine	71.58	70.9
Phenylalanine	55.47	78.55
Threonine	75.26	67.20
Valine	62.66	62.11
Tryptophan	55.38	70.2
Alanine	52.08	72.59
Asparagine	69.77	71.48
Cysteine	53.91	70.8
Glutamic acid	83.05	81.0
Glysine	69.22	70.4
Proline	52.5	71.42
Serine	76.89	70.8
Tyrosine	80.77	70.4

*Sorghum-Barley Brewer's spent Grain; [1] Organic matter

Table 6 - Growth performance of birds fed different levels of SBBSG

PARAMETER	T1 0%SBBSG[1]	T2 4%SBBSG	T3 8%SBBSG	T4 12%SBBSG	T5 16%SBBSG	SEM	P-VALUE
ADFI (g)	105.59[a]	102.30[a]	92.92[b]	93.35[b]	88.26[c]	1.50	<0.01
ADG (g)	52.79[a]	51.15[a]	48.31[a]	48.54[a]	48.54[a]	1.84	0.79
FCE	0.50[b]	0.50[b]	0.52[ab]	0.52[ab]	0.55[a]	0.01	0.04
FNBW (kg)	2.95	2.86	2.71	2.72	2.72	.170	0.65

[1] Sorghum-Barley Brewer's Spent Grain: [a,b,c], Means within the same row with different superscripts are significantly different (P<0.05):SEM: Standard error of the mean

Table 7- Carcass parameters of birds fed different levels of SBBSG

Parameter	T1 0% SBBSG[1]	T2 4% SBBSG	T3 8% SBBSG	T4 12% SBBSG	T5 16% SBBSG	SEM	P-Value
Chilled wt./ bird (g)	2584.7	2596.3	2461.0	2515.3	2528.3	79.5	0.75
Carcass wt./ bird (g)	2323.7	2308.5	2215.3	2260.7	2251.9	74.9	0.84
Viscera wt./ bird (g)	261.01	287.87	245.67	254.6	276.3	26.8	0.81
Fat wt./ bird (g)	32.2	26.07	24.93	26.73	25.00	2.9	0.37
Fat(% of chilled weight)	1.23	0.99	1.01	1.07	1.01	0.1	0.49
Fat(% of carcass weight)	1.37	1.12	1.20	1.19	1.12	0.1	0.53

[1] Sorghum- Barley Brewer's Spent Grain; SEM: Standard error of the means, SEM: Standard error of the means

Table 8 - Effect of diet on blood hematological parameters of birds

Parameter	T1 0% SBBSG[1]	T2 4% SBBSG	T3 8% SBBSG	T4 12% SBBSG	T5 16% SBBSG	SEM	P-Value
WBC (10^9/L)	267.1	270.9	291.2	264.8	259.7	8.19	0.105
RBC (10^{12}/L)	1.84	1.79	2.57	1.81	1.72	0.22	0.079
HGB (g/dL)	7.42	7.54	9.00	6.60	7.24	0.95	0.503
HCT (%)	20.60	23.12	30.34	23.58	21.34	2.49	0.084
MCV (fL)	123.1	128.7	118.3	123.1	124.3	2.71	0.158
MCH (pg)	40.20	42.10	42.04	40.52	41.86	0.94	0.466

[1]Sorghum-Barley Brewer's Spent Grain; WBC: white blood cell, RBC: red blood cell, HGB (g/dL): heamoglobin (gram per deciliter), HCT: hematocrit, MCV (fL): mean corpuscular volume (femtoliters), MCH (pg): mean corpuscular haemoglobin (pigograms); SEM: Standard error of the mean

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Table 9 - Effect of diet on blood biochemical parameters of birds							
Parameter	T1 0% SBBSG	T2 4%SBBSG	T3 8%SBBSG	T4 12%SBBSG	T5 16%SBBSG	SEM	P-Value
ALP (U/L)	3785.1[ab]	3254.7[b]	4546.1[a]	3978.3[ab]	3778.7[ab]	268.31	0.043
AST (U/L)	10.62	10.32	11.06	19.14	9.8	2.36	0.059
GGT (U/L)	16.20[b]	18.17[b]	15.90[b]	24.84[a]	27.06[a]	1.86	<0.05
T. Bilirubin (µmol/L)	2.52	3.22	2.68	2.57	2.74	0.49	0.86
Protein (g/L)	40.79	42.33	42.09	39.76	40.33	2.76	0.955
Albumin (g/L)	14.05	15.76	15.92	14.65	15.26	0.91	0.589
Urea (mmol/L)	0.46	0.36	0.60	0.58	0.42	0.11	0.534
Creatinine (µmol/L)	15.70	13.58	18.76	17.44	16.84	1.89	0.403
Glucose (mg/dL)	260.78[a]	238.58[b]	260.22[ab]	258.90[ab]	280.82[ab]	7.67	0.0187
UricAcid (µmol/L)	243.16	169.02	239.86	153.08	220.81	31.81	0.188
Cholesterol (mmol/L)	2.46	2.68	2.80	2.78	2.72	0.15	0.535
Triglycerides (mmol/L)	0.76	0.64	0.94	1.02	0.80	0.11	0.172
HDL (mmol/L)	1.14	1.32	1.12	1.22	1.18	0.08	0.632
LDL (mmol/L)	1.02	1.08	1.26	1.12	1.16	0.09	0.527

ALP: alkaline phosphatase, AST: aspartate aminotransferase, GGT: Gamma-glutamyltransferase, T. Bilirubin: total bilirubin, HDL: high density lipoprotein, LDL: low density lipoprotein, U/L: units per liter, µmol/L: micromoles per liter, g/L: gram per liter, mmol/L: millimoles per liter, mg/dL: milligram per deciliter; SEM: Standard error of the mean

DISCUSSION

Chemical Analysis

In initial trials using SBBSG (Nortey et al., 2013: Manu-Barfo et al., 2013) in diets for both layers and broilers, the authors made certain assumptions with regards to nutrient, particularly amino acid content. These assumptions had been based on work done by Donkoh and Attoh-Kotoku (2009), using BSG and on values obtained in other scientific literature (NRC, 1994). The analyzed results of wheat bran used in this trial were compared to the analyzed results of Donkor and Attoh-Kotoku (2009), to serve as a check and a validation for the protocols. The results indicated similarities in the crude protein and most amino acid values. Of the essential amino acids Lys, Met, Cys, Thr, Val and Leu, analyzed results were 0.66, 0.20, 0.38, 0.50, 0.75 and 0.96% which were comparable to cited literature values of 0.66, 0.22, 0.34, 0.48, 0.79 and 0.98% respectively. Generally the crude protein content of SBBSG was higher than BSG (26.95 vs. 20.7% respectively). Chemical composition and amino acid profile can vary according to the variety of grain, harvest time, malting and mashing conditions (Mussatto et al., 2006). The higher protein content of the SBBSG translated to slightly higher values for most of the amino acids. Comparing SBBSG used in this trial to BSG (Donkor and Attoh-Kotoku, 2009), Lys, Met, Cys, Thr and Val and Leu values were 0.77, 0.44 0.44, 0.90, 1.26, 2.79 and 0.76, 0.39, 0.52, 0.72, 1.21 and 1.64% respectively. Protein values for BSG as reported by Westendorf and Wohlt (2002) ranged from 21 to 29%%. Similarly, Adama and Ribadu (2003) and Olorunnisomo et al., (2006) reported protein values for BSG similar to what was reported for SBBSG in this study. However it is clear from this study that similarities in protein content between SBBSG and similar brewery by-products, did not translate into similarities in amino acid contents. In monogastric feed formulation however, a greater emphasis needs to be placed on amino acid composition and availability, and not on protein content per se (Dalibard et al., 2014)

Nutrient digestibility

The AME of the wheat bran that was used as a validation was 6.01MJ/kg and this was comparable to the values obtained by Donkoh and Attoh-Kotoku (2009) who obtained a value of 5.80MJ/kg. For the SBBSG, an AME value of 7.22MJ/kg was obtained. This value was much higher than what was assumed in the trial by Nortey et al. (2013) and by Manu-Barfo et al. (2013). The higher AME level of the SBBSG used in this trial compared to what was obtained for BSG (Donkor and Attoh-Kotoku, 2009), could be a direct result of the fat content (8.85% vs 6.01%). Essential amino acids cannot be synthesized by poultry, therefore they must be provided in the diets of the birds at the right levels and proportions (Kim et al., 2008). The ileal digestibilities of some essential amino acids like Lys, Met and Cys (42.93, 71.58 and 53.91 %) were 43.58, 13.13 and 15.89% lower than the assumed values of 76.1, 82.4 and 64.1% obtained in the trial by Donkoh and Attoh-Kotoku (2009) and which was used in an earlier broiler trial (Nortey et al., 2013).

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Generally nutrient digestibility is a result of several factors including the age of the birds, processing of the ingredient and the presence of anti-nutritive factors (ANF) like fibre (Schulze et al., 1994; Lenis et al., 1996; Slominski et al., 2004). The crude fibre content of the SBBSG used in this study was 15.66 (Table 4). This is high when compared to what was obtained by Madubuike and Obidimma (2009). The two major grains from which SBBSG was obtained are sorghum and barley. The major ANFs found in barley are arabinoxylans, and beta glucans (Aalto et al., 1988; Andersson et al., 1999; Zijlstra et al., 1999), while those found in sorghum are phytic acid, trypsin and amylase inhibitors (Mohammed et al., 2010). Research indicates that high amount of dietary fibre reduces nutrient availability to poultry and swine (Schulze et al., 1994; Lenis et al., 1996; Slominski et al., 2004).

It may therefore be speculated that the reduced digestibilities of some amino acids observed in SBBSG was a direct result of the presence of these ANFs.

Growth performance

Average daily feed intake (ADFI). Several factors affect ADFI in broilers. Feed intake is influenced by stocking density, water supply, fibre, the nature and the palatability of the feed, energy content of the feed, health status of the birds and stress (Ferket and Gernat, 2006). With the exception of feed, all the other conditions were held constant. Generally as the level of SBBSG increased in the diet, feed intake reduced. The results were similar to the findings of Boudouma (2010) who observed a reduction in the feed intake when diets containing high levels of Brewers' spent grain (> 13 %) were presented in the mash form for broilers. On the other hand the results were in disagreement with reports from Ash and Akoh (1992), Opara (1996), Omekan (1994), Esonu et al. (2002) who reported increased feed intake as the fibre level in the diet increased. As the level of fibre increases in a diet, monogastrics tend to increase their feed intake in an attempt to meet their nutrient (particularly energy) needs (Leeson and Summers, 1997). This is because increasing fibre levels tend to dilute the energy density of the feed. This phenomenon has been observed in broilers by Adeyanju et al. (1976) and Alemawor et al. (2010) and in layers by Umar Faruk et al. (2010). In this trial, the birds were fed *ad-lib*, and it was expected that birds would consume more of T5 than T1 or T2, due to an increase in dietary SBBSG, and consequently an increase in the fibre content. Dietary fibre, in addition to diluting the energy content of the feed, is known to affect rate of passage in the gastro-intestinal-tract (GIT) of birds (Montagne et al., 2003; Ferket and Gernat, 2006; Saki et al., 2011).

Sorghum Barley Brewers Spent Grain contains high levels of NSPs. In an earlier trial, Manu-Barfo et al. (2013) determined that broiler grower diets containing 4% and 16% SBBSG contained 9.39 and 12.26% total NSP's respectively. Of the 9.39% NSP contained in the 4% SBBSG diet, 2.21 % was insoluble, while 7.18% was soluble. However the insoluble vs soluble NSP in the 16% SBBSG diet was 5.57 and 6.68% respectively. It can be seen that SBBSG contains relatively more insoluble than soluble fibre. According to Jørgesen et al. (1996) water insoluble NSPs tend to reduce transit time in the GIT. A reduction in transit time, will result in a longer period of satiety which will ultimately result in a reduction ADFI (De Leeuw et al., 2008; Rochell et al., 2012). It is also possible that the higher fat content of SBBSG compared to wheat bran, may have contributed to the lower intakes of the diets containing SBBSG.

Average daily gain (ADG) and FCE. Feed intake influences the body weight gain and feed conversion efficiency (Ferkert and Gernat, 2006). However in this trial, there was no effect of dietary SBBSG level on ADG, although a numerical trend towards slight reductions were observed. Thus the expected drastic reductions in ADG that normally accompany a reduction in feed intake were not observed in this trial. The absence of this difference resulted in better feed efficiency as the level of SBBSG increased in the diet. In the present trial, nutrient availabilities, as opposed to total nutrient content were used to formulate diets to meet the nutrient requirements for COBB500 broiler birds (COBB, 2015). This was possible following the determination of nutrient availabilities in SBBSG in the digestibility trial. According to Cavalcanti and Behnke (2004), and Dalibard et al. (2014), formulating diets for monogastrics animals based on nutrient availabilities results in better feed efficiency and growth rates. The lack of any effect on ADG when ADFI was reduced could be due to the fact that hens were more efficient at utilizing the available nutrients when feed intake was reduced. This phenomena has also been observed by Sklan et al. (2003) and Alvarado et al. (2007).

Carcass parameters. There were no dietary effects on any of the carcass parameters studied. Generally as the level of dietary fibre increases and energy is diluted, ADFI increases. This can cause an increase in intestinal weight of birds (Sulieman and Abd-Ra-Mabrouk, 1999; Nortey et al., 2013) and is a compensatory effect that is intended to support the extra feed consumed. In this study no such effect was observed and it may be a direct result of the fact that there was no corresponding increase in ADFI with increased dietary fibre levels. Earlier studies using SBBSG (Manu-Barfo et al., 2013) in broiler diets, resulted in an increase in the abdominal fat of birds fed 12 and 16% SBBSG. However in that trial, assumed digestibility values based on earlier work by Donkor and Attoh-

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Kotoku (2009) had been assumed. For this particular trial, and using this special SBBSG, real ileal digestibilities of nutrient were determined and used in formulating the broiler diets. A precise ratio of dietary ME to amino acid is required to control fat accumulation in broiler finishers and maintain superior carcass characteristics (Bregendahl et al., 2002) and in the absence of such precise information, there was an excess accumulation of fat as was observed by Manu-Barfo et al. (2013). In this trial there was no excess abdominal fat accumulation by birds fed any of the SBBSG treatments because a precise knowledge of nutrient availabilities had been determined and used in dietary formulation.

Blood hematological and biochemical properties

Changes and deviations from the norm in blood hematological properties are an indication of a physiological disorder that may not yet be exhibiting external clinical signs (Togun et al., 2007). For this trial there were no differences in any of the hematological parameters studied. Also the values obtained were within the normal ranges for broilers as was reported by Bowes et al. (1989), Ikhimioya et al. (2000) and Talebi et al. (2005).

There were some observed differences in some of the biochemical indices that were studied. These included alkaline phosphatase (ALP), gamma-glutamyl transpeptidase (GGT) and glucose.

The Gamma-Glutamyl Transpeptidase test is used to detect liver disease and bile duct obstructions. An increased GGT level indicates that an individual's liver is being damaged. Normal ranges for GGT have been reported in healthy chicken from 21.28 to 37. 32 units per liter (U/l) (Silva et al., 2007), 7.78 to 16.07 U/L (Café et al., 2012), and 23.56 to 27.79 U/L (Kuttappan et al., 2012).

Thus although there existed some differences in GGT levels in this trial, all the values were within the normal range. The level of glucose in the blood at any time may be influenced by the time it is measured post-prandial and also on the type of carbohydrate in the diet (Wheeler and Pi-Sunyer, 2008). Thus the level of glucose in the blood may be slightly higher immediately post prandial than when the individual took a meal a few hours prior, and is in a state of hunger. Also easily digestible carbohydrates will result in quicker spikes in blood levels of glucose compared to slower digestible carbohydrates. The differences in blood glucose levels of birds in this trial were within the normal range of 200 – 500mg/dL (Jain, 1993; Thrall, 2007) and the observed differences in blood glucose levels could be due to time post-prandial, and/or activity level of the birds immediately pre-sampling. All other biochemical parameters were not different, indicating that the birds were not sick

CONCLUSIONS

It is concluded from this study that:

- The AME of SBBSG is slightly higher, while amino acid content and digestibilities are generally lower than earlier studies reported
- When the basis of feed formulation is on nutrient availability and not on total nutrient content, SBBSG can be included in diets for broilers up to 16% without negatively affecting performance.
- There are no negative health effects on broilers when SBBSG is included in broiler diets up to 16%

DECLARATIONS

Acknowledgements

The authors wish to acknowledge the following for their assistance: A) Dr. H. Stein of the Department of Animal Science, University of Illinois at Urbana-Champaign, U.S.A., for assisting in gross energy determination, and amino acid analyses of the feed, ingredients, digesta and faecal samples. B) The Office of Research, Innovation and Development (ORID) of the University of Ghana, for their financial support.

Authors' Contributions

TNN is the Principal Investigator who designed the trial, formulated the feed and supervised the laboratory work and all aspects of the experiments. RJ carried out the day-to-day work on the farm, conducted the laboratory work and put together the draft version of the manuscript. AAN participated in the design of the study, helped with the statistical analysis and helped in coordinating and drafting the manuscript.

Ethics

The animal protocol used followed principles and ethical procedures recommended by the Institutional Animal Care and Use Committee of the Noguchi Memorial Institute for Medical Research, University of Ghana

Consent to publish

We the authors of this manuscript, titled "Effect of metabolizable energy content and ileal amino acid digestibility of sorghum barley brewers spent grain on growth, carcass and blood parameters in broilers" do hereby give consent for this manuscript to be published

Availability of data and materials

Not applicable

Competing interest

The authors declare that they have no competing interests.

REFERENCES

AOAC (2000). Association of official Analytical Chemists. Official method of Analysis, 17th edition. Washington D.C. USA.

Aalto T, Lehtonen M and Varo P (1988). Dietary fibre content of barley grown in Finland. Cereal Chemistry, 65(4): 284-286.

Adama TZ and Ribadu SA (2003). Feed intake, growth performance and nutrient digestibility of rabbits fed diets containing varying levels of sorghum dried brewers' spent grains (SDBG). Journal of Sustainable Tropical Agricultural Research, 5: 1-5.

Adedokun SA, Parsons CM, Lilburn MS, Adeola O and Applegate TJ (2007). Standardized illeal amino acid digestibility of meat and bone meal from different sources in broiler chicks and turkey pouts with a nitrogen-free or case in diet. Poultry Science, 86: 2598-2607.

Adeyanju SA, Oguntuga DBA, Sonaiya EB and Eshiett N (1976). Further studies on the utilizations of cocoa pod in ruminants rations. Nigerian Journal of Animal Production, 3: 139-143.

Alemawor A, Oddoye EOK, Dzogbefia VP, Oldham JH and Donkoh A (2010). A broiler performance of finisher diets containing different levels of either *Pleurotus ostreatus*- fermented dried cocoa pod husk or dried cocoa pod husk supplemented with enzymes. Tropical Animal Health Production, 42: 933-939.

Alvarado GJM, Jiménez-Moreno E, Lázaro R and Mateos GG (2007). Effects of type of cereal, heat processing of the cereal, and inclusion of fiber in the diet on productive performance and digestive traits of broilers. Poultry Science, 86: 1705–1715.

Andersson AAM, Elfverson C, Andersson R, Regne'r S and Aman P (1999). Chemical and physical characteristics of different barley samples. Journal of the Science of Food and Agriculture, 79: 233-242.

Ash AJ and Akoh Detaia L (1992). Nutritional value of *Sesbania grandiflora* leaves for ruminants and monogastrics. Tropical Agriculture (Trinidad).

Babiker MS, Kijora C, Abbas SA and Danier J (2009). Nutrient composition of main poultry feed ingredients used in Sudan and their variations from local standard table values. International Journal of Poultry Science, 8 (4): 355-358.

Boudouma D (2010). Prediction models of the metabolizable energy of wheat brans. Livestock Research for Rural Development, 22 (2).

Bowes VA, Julian R and Stirtzinger T (1989). Comparison of serum biochemical profiles of male broilers with female broilers and White Leghorn chickens. Canadian Journal of Veterinary Research, 53(1): 7-11.

Bregendahl K, Sell JL and Zimmerman DR (2002). Effect of low protein diets on growth performance and body composition of broiler chicks. Poultry Science, 81: 1156-1167.

Café MB, Rinaldi FP, Morais HR, De Mattos Nascimento MRB, Mundim AV and Marchini CFP (2012). Biochemical blood parameters of broilers at different ages under thermoneutral environment. Proceedings of WPC2012, Salvador Bahia, Brazil

Cavalcanti BW and Behnke CK (2004). Effect of wheat bran phytase subjected to different conditioning temperatures on phosphorus utilization by broiler chicks based on body weight and toe ash measurement. International Journal of Poultry Science, 3: 215-219.

COBB (2015). COBB 500 Broiler performance and nutrition supplement. Retrieved December 25, 2017, from http://www.cobb-vantress.com/docs/default-source/cobb 500guides/Cobb500_Broiler_Performance_And_Nutrition_Supplement.pdf.

Dalibard P, Hess V, Le Tutour L, Peisker M, Peris S, Gutierrez AP and Redshaw M (2014). Amino acids in animal nutrition. Fefana publication. Visited December 25, 2010, from http://www.aquafeed.com/documents/1430685417_1.pdf.

De Leeuw JA, Bolhuis JE, Bosch G and Gerrits WJJ (2008). Effects of dietary fibre on behaviour and satiety in pigs. Proceedings of the Nutrition Society, 67: 334–342.

Donkoh A and Attoh-Kotoku V (2009). Nutritive value of feedstuffs for poultry in Ghana: chemical composition, apparent metabolizable energy and illeal amino acid digestibility. Livestock Research for Rural Development, 21(3): 1-8.

Esonu BO, Iheukwumere FC, Emenalom OO, Uchegbu MC and Etuk EB (2002). Performance Nutrient Utilization and Organ Characteristics of broiler finisher fed *Microdesmis puberula* leaf meal. Livestock Research for Rural Development, 14: 15.

FAO (2011). Feed Resources Information System, Animal Health and Production Division.

Fenton TW and Fenton M (1979). An improved procedure for the determination of chromic oxide in feed and faeces. Canadian Journal of Animal Science, 59: 631-634.

Ferket PR and Gernat AG (2006). Factors that affect feed intake of meat birds: A Review. International Journal of Poultry Science, 5: 905-911.

Ikhimioya A, Arijeniwa I, Oleku T and Ahmed A (2000). Preliminary investigation on the haematology of the Nigerian indigenous chicken. Proceeding of the 5th Annual Conference of Animal Science Association of Nigeria, Port Harcourt, pp. 10-12

Jackson S, Summers JD and Leeson S (1982). Effect of dietary protein and energy on broiler carcass composition and efficiency of nutrient utilization. Journal of Poultry Science, 61: 2224-2231.

Jain NC (1993). Essentials of Veterinary hematology. Lea & Febigner, Philadelphia.

Jørgesen H, Zhao XQ, Bach Knudsen KE and Eggum OB (1996). The influence of dietary fibre source and level on the development of the gastrointestinal tract, digestibility and energy metabolism in broiler chickens. British Journal of Nutrition, 75: 379-395.

Kim JC, Mullan BP, Hampson DJ and Pluske JR (2008). Addition of oat hulls to an extruded rice-based diet for weaner pigs ameliorates the incidence of diarrhoea and reduces indices of protein fermentation in the gastrointestinal tract. British Journal of Nutrition, 99(6): 1217-1225.

Kuttappan VA, Goodgame SD, Bradley CD, Mauromoustakos A, Hargis BM, Waldroup PW and Owens CM (2012). Effect of different levels of dietary vitamin E (DL-α-tocopherol acetate) on the occurrence of various degrees of white striping on broiler breast fillets. Poultry Scieince, 91: 3230–3235.

Leeson S and Summers JD (1997). Commercial poultry nutrition. 2nd Edition. University Books, Guelph, ON.

Lenis NP, Bikker P, Van Meulen J, Van Diepen JTM, Bakker JGM and Jongloed AW (1996). Effect of dietary neutral detergent fiber on ileal digestibility and portal flux of nitrogen and amino acids and on nitrogen utilization in growing pigs. Journal of Animal Science, 74: 2687-2699.

Madubuike FN and Obidimma VN (2009). Brewers dried grains as energy source of external and internal egg qualities of laying hens. In: Proceedings of the 34th Annual conference of Nigeria Society of Animal Production, Uyo, Nigeria.

Manu-Barfo PI, Nortey TNN and Naazie AI (2013). Effect of sorghum-barley brewers' spent grain as a feed ingredient on broiler performance and carcass characteristics. Bulletin of Animal Health and Production in Africa, 61: 67-76.

Mohammed NA, Mohammed IA and Babiker EE (2010). Nutritional elevation of sorghum flour (sorghum bicolor L. Moench) during processing of injera. International Journal of Biological and Life Sciences, 6: 35-39.

Montagne L, Pluske JR and Hampson DJ (2003). A review of interactions between dietary fibre and the intestinal mucosa, and their consequences on digestive health in young non-ruminant animals. Animal Feed Science Technology, 108: 95–117.

Mussatto SL, Dragone G and Roberto IC (2006). Brewer's spent grain: generation, characteristic and potential applications. Journal of Cereal Science, 42: 205-212.

NRC (1994). Nutrient requirement of poultry, 9th revised edition. National Academy Press, Washington D.C.

NRC (2000). Nutrient requirement of poultry, 10th revised edition. National Academy Press, Washington D.C.

Nortey TNN, Manu-Barfo P and Naazie A (2013). Effect of sorghum barley brewers' spent grain on broiler performance and carcass characteristics. Bulletin of Animal Health and Production in Africa, 61: 67-76.

Olorunnisomo OA, Adewuni MK and Babayemi OJ (2006). Effect of nitrogen level on the utilization of maize offal and Sorghum brewers grains in sheep diets. Livestock Research for Rural Development, 18: 112-121.

Omekan VN (1994). Studies on Nutrition and health implications of dietary inclusion of dried poultry waste for broilers. MSc. Thesis, Federal University of Technology, Owerri, Nigeria.

Ondwasy H, Wesonga H and Okitoi L (2006). Indigenous chicken production manual. Kenya Agricultural Research Institute Technical Note Series. Retrieved February 18, 2006 from http://www.kari.org/fileadmin/publications/tech_notes/TecNote18.20060810.pdf.

Opara CC (1996). Studies on the use of Alchornia cordifolla leaf meal as feed ingredient in Poultry diets. MSc. Thesis, Federal University of Technology, Owerri, Nigeria.

Osei SA, Aggrey PK and Afful BR (2010). Effects of partial replacement of fishmeal with locally produced soybean meal on the performance and carcass characteristics of broiler chickens. Ghana Journal of Animal Science, 5(2): 100-105.

Ravindran V (2007). Standardized Ileal Digestibility. The Poultry Site. Retrieved December 26, 2017 from www.thepoultrysite.com/articles/317/standardised-ileal-digestibility.

Ravindran V (2013). Feed resources for poultry production in Asia and the Pacific. III. Animal protein sources. World's Poultry Science Journal, 49: 219–235.

Rochell JS, Applegate JT, Kim JE and Dozier III AW (2012). Effect of diet type and ingredient composition on the rate of passage and apparent ileal amino acid digestibility in broiler chicks. Poultry Science, 91: 1647-1653.

Saki AA, Hemati Martin HR, Zamari P and Mirzaaghatabar F (2011). Non starch polysaccharides and broiler responses. World Applied Science Journal, 15(2): 192-198.

SAS Institute (2003). SAS User's Guide. SAS Institute, Cary, NC.

Schulze H, Van Leevven P, Verstegen MWA and Vanden Berg JWO (1994). Dietary level and source of neutral detergent fibre and ileal endogenous nitrogen flow in pigs. Journal of Animal Science, 73: 441-448.

Sibbald IR (1986). The T.M.E. system of feed evaluation: methodology, feed composition data and bibliography. Technical Bulletin 1986-4E. Animal Research Centre, Research Branch, Agriculture Canada, Ottawa, Canada.

Silva RL, Sérgio T, Sobrane F, Otto Mack J, Antonio CL, da Silva RF, da Silva RM and Duarte KF (2007). Effects of mycotoxin adsorbents in aflatoxin B1- and fumonisin B1-contaminated broiler diet on performance and blood metabolite. Revista Brasileira de Zootecnia, 45(5): 250-256.

Sklan D, Smirnov A and Plavnik I (2003). The effect of dietary fiber on the small intestines and apparent digestion in the turkey. British Poultry Science, 44: 735–740.

Slominski BA, Boros D, Campbell LD, Guenter W and Jones O (2004). Wheat by-products in poultry nutrition. Part 1. Chemical and nutritive composition of wheat screenings, bakery by-products and wheat mill run. Canadian Journal of Animal Science, 84: 421-428.

Sulieman YR and Abd-Ra-Mabrouk A (1999). The Nutrient Composition of Sudanese Animal Feeds (Bulletin 111). Animal Production Research Centre Publications, Khartoum North, Sudan.

Talebi A, Asri-Rezaei S, Rozeh-Chai R and Sahraei R (2005). Comparative studies on haematological values of broiler strains (Ross, Cobb, Arbor acres and Arian). International Journal of Poultry Science, 4(80): 573-579.

Thrall MA (2007). Hematologiae bioquímica clínica veterinária. Roca, São Paulo.

Togun VA, Oseni BSA, Ogundipe JA, Arewa TR, Hammed AA, Ajonijebu DC and Mustapha F (2007). Effects of chronic lead administration on the haematological parameters of rabbits – a preliminary study. Proceedings of the 41st Conference of the Agricultural Society of Nigeria, pp. 341.

Umar Faruk M, Bouvarel I, Meme M, Rideau N, Roffidal L, Tukur HM, Bastianelli D, Nys Y and Lescoat P (2010). Sequential feeding using whole wheat and a separate protein-mineral concentrate improved feed efficiency in laying hens. Poultry Science, 89: 785–796.

USDA (2013). Ghana Poultry and Poultry Products. Annual 2013 Gain Report.

Westendorf ML and Wohlt JE (2002). Brewing byproducts: their use as animal feeds. Veterinary Clinics of North America: Food Animal Practice, 18: 233-252.

Wheeler ML and Pi-Sunyer FX (2008). Carbohydrate Issues: type and Amount. Journal of the American Dietetic Association, 108(4): 34–39.

Zijlstra RT, de Lange CFM and Patience JF (1999). Nutritional value of wheat for growing pigs: chemical composition and digestible energy content. Canadian Journal of Animal Science, 79: 187-194.

2018 SCIENCELINE

Online Journal of Animal and Feed Research

Volume 8, Issue 2: 33-38; Mar25, 2018 ISSN 2228-7701

REVIEW ON: ASSESSMENT OF CONVENTIONAL ANIMAL FEED SUPPLY IN AND AROUND NORTH GONDAR ZONE, ETHIOPIA

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ABSTRACT: Assessment was partially done as per the syllabus prepared by Sustainable Resources Management Program of North Gondar Zone (SRMP-NG) financed by Austrian Government. The assessment was conducted in six randomly selected districts of North Gondar zone in the year 2015. The objectives of the study were; to assess and estimate the existing agro-industrial by-product feed for cattle and feedlot operators, to depict the feed stocks available for ration formulation and to measure industrial by-products of oil seed cakes and powdery mill (brans) in the study area. The assessment result was showed that, Gondar town was found to be the highest potential for agro-industrial by-product feed accounts about 560106 and 493436 quintal. The reason might be due to the availability of large number of feed processing factories in the town but bran could not found any other districts other than Gondar town. Grain milling factories produces bran were found in Gondar town and supplies feed to different function of animals. The other produced very minimal due to factory owners are argumentative on the current tax set by the government which, is beyond the production capacities of the factories.

Keywords: Conventional feed, Food Processing Plant, Oil Seed Cakes, Barn, Ethiopia.

REVIEW

pii: S222877011800005-8

Received 14 Aug. 2017

Accepted 05 Feb. 2018

INTRODUCTION

An adequate supply of livestock feed is crucial important to the livelihoods of millions of people across the developing world and not just for smallholders, but also for pastoralists and the large number of landless who depend mainly on common land for grazing and browsing animals (Nansen, 1990). Intercropping of forage legumes with cereals offers a potential for increasing forage biomass yield and consequently, livestock production in sub-Saharan Africa. But in such a system the yield depression of the cereal grain should be minimal, possibly not more than 15%, for it to be acceptable by the farmer (Jaetzold and Schmidt, 2006).

The time of sowing of cereal and legume intercropping is critical for the yield of each crop and data so far available indicate that under sowing within 10 days of planting a fast-growing cereal such as barely does not depress cereal grain yield significantly, but with slow-growing, long-season crops such as photosensitive sorghum, grain yield is greatly depressed. In the case of sorghum, high grain yield is obtained if the legume is sown three to four weeks after the cereal (Kabirizi, et al., 2004).

Intercropping of forage legumes and cereals generally results in higher fodder crude protein yield (CPY) than cereal alone. However, fairly high yields of legumes are needed to augment the cereal residues in order to produce a feed composition capable of meeting the basal nutritional requirements of ruminant animals. The effects of intercropping on soil fertility vary with management practice and it is estimated that legume roots contribute between 5 and 15 kg N/ha to soil N under intercropping system (Lanyasunya et al., 2006).

Livestock production in the tropics and sub-tropics with the absence of supplementary feed to the different condition of animal is ridiculous Malede, 2012). Livestock production can be increased through increasing the

To cite this paper: Birhan M and Mekuriaw Y. (2018). Review on: assessment of conventional animal feed supply in and around North Gondar zone, Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 33-38. www.ojafr.ir

productivity per animal and per unit area of land (Malede, 2012). A major factor in increasing livestock productivity will be the improvement of animal nutrition and feed supplies, especially in the case of ruminant livestock's and absence of agro-industrial by-product use in the study area is paramount important. Improved livestock diseases and parasite control, breeding and management will also be important, but initially, a major emphasis must be placed on providing better nutrition for ruminant livestock production (Whitman et al., 1990).

The natural grazing land in the study area consists of largely wide range of grasses, legumes and other herbaceous plant species (David, 2006). The existing feed stuffs in Ethiopia particularly in the study area of North Gondar zone is poor in quality and quantity which, provides insufficient protein, energy, vitamins, and minerals (Smith, 2002). Therefore, the importance of dealing the agro-industrial by-product feeds used as livestock feeds are a common practice for long period of the year in the study area (Sarkunas et al., 2004). Large quantity of agro-industrial by-products was produced in each year by different types of food processing plants in the study area (Methu, 1998). With the ever growing human population pressure, problems of land re-allocation in each district make competition between grazing land and crop land. In reality developing countries like Ethiopia which attempts to adopt to the use of those products are the better management and utilization of agricultural resources in the area (ARC, 1984).

The agro-industrial by-products produced in the entire district were sold to the people who are involved in the different livestock farm activities like private dairy producers, cattle fatteners, small scale individual dairy owners and farmers were used as maintenance and mach of which were used for production purpose in the study area (Lukuyu et al., 2009). Therefore, to achieve and full fill the aforementioned goals, the assessment was focused on the following specific objectives. To assess and estimate the existing agro-industrial by-product feed resources and formulating standardized ration for the different condition of animals in the study area.

Even though there is no reliable information about number of livestock censes in national as well as regional level and the current figures are estimated based on a various documents which was organized by different sectors. So far no formal censes has been done either by the central statistic authority or any other concerned organization in the country and hence the figure presented here is apparent.

MATERIALS AND METHODS

The number of each animal shown in table one above in the form of tropical livestock unite (TLU) which could be converted by using conventional conversion factors obtained by different literatures. High number of cattle (TLU) was found in all the districts which is about 4557 shown in (Table 1) this may be due to the contribution of cattle may be very high as compared to other animal found in the area.

Livestock populations in the assessment districts estimated in the above were well mentioned in each locality which posse's cattle is the highest and sheep and goat are followed second and third in each district respectively this is due to their multi-purpose function of the animal for different societies of the area. Moreover, equines (donkey, horse and mule) also found in all district and Gondar town correspondingly. Even though, camel is the most important animal in the tropical and sub-tropical area of the country, only few numbers of camels were found in Chillga district which has a total number of 125, these is due to the climatic condition and the adaptability of camels are very limited in other districts. The economic importance of camels especially in the desert and semi-desert area of the country has a tremendous contribution like, transportation of peoples and different goods from the farm community to the market centers in the area but the environment is not conducive for survival in the central and central highlands of the Ethiopia that makes limited in their availability. Camel has a strong resistance for overcoming in shortage of water, feed and hot temperature and has the ability to give reasonable products in the fragile environment of the country.

RESULTS AND DISCUSSION

Oil Seeds by products

These products are perhaps, the most important groups agro-industrial by-product feed for livestock feeding. Oil seed cakes are rich in its protein contents in most cases natural grasses, herbages and other agricultural by-products deficient in nutrients which need for supplementary feeds for all types of animal to increases the overall productivity of livestock but also to make more efficient use of protein deficient feed resources (Calo, 1997). The farming communities are well experienced for purchasing of oil seed by-products to their animals particularly during the dry period in all study districts.

In the study area we have assessed three types of Agro-industrial by-products which are used as livestock feeds involving by different activities in the area. One of the most important energy sources feed types are

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produced from various grain milling by-products which are commonly called bran's, and has a total production potential of 493436 quintals of various type of bran.

Livestock production and productivity in the area has become increasing and the income generated from livestock and livestock products in terms of price either live animal or their products show a tremendous changes and the living standards of the farmer's found in the study area which agro-industrial by-products for their animal has become improving (Smith et al., 1990). The remaining feed types produced from various types of oil producing factories which are mostly an assortment of oil seed cakes used as source of protein supplement feeds for feeding of ruminant livestock produced) quintals.

The total annual production potential of the of the various oil seed squeezing by different factories was (1511286) quintals in (Tables 3 and 4) of cakes produced in the study area. These are immense contributors to supply for animal feed and improve the existing protein deficiency present in most of the grazing grasses and herbages used by livestock feeds (Owen and Aboud, 1998).

As we observe from the above (Table 6) the highest by-product produced among the six districts is Gander zuria, which is the potentially high production as a total of 26,134 quintals in different types of oil seed cakes in the year 2000 E.C. On the other hand the livestock population indicates very minimal which showed the second from the last which has the total livestock population of 23784 and this showed that there may be a positive relationship between the feed resources availability with existing livestock population. Wogera District has a huge livestock population which indicated (151,837.5) and has feed production potential of Agro-industrial by-products has become very less showing that (7300 quintals only oil seed cakes) in the year 2000 E.C and this indicates, there is some gaps between feed resource availability with the present livestock population in the area.

In addition to this Dembia district is next to Gondar zuria in potential of Agro-industrial feed production potential (18,250 quintals) this showed that, there is stability between feed resources availability with the present livestock population as compared to Wogera District. Gondar town is the most leading Agro-industrial by-product production potentials which has 274,288 quintals of diverse feed resources were produced in the same year. The total livestock population was estimated 77,570 as showed above well mentioned there is optimal feed resources availability with the present livestock population in the area. The main limitation to increased use and production of agro-industrial by-products in rural areas is the fact that these materials are usually produced in urban or pre-urban areas where most of the agro-industrial processing plants or industries are located. Therefore, if these by-products are to be utilized by smallholder farmers, they have to be transported to rural areas. As result this makes them often quite expensive. These products are also highly demanded by the commercial farmers who have advantage over small-scale farmers in terms of purchasing power and availability of own transport to their farms (Sarkunas, 2004).

Economic Analysis of the Feed Assessment

The economic analysis of the smallholder cattle feeding program involves the examination of the overall profitability of the livestock products and prices of live animals, the determinants of the profitability and possible measures for improving the economic performances of the participating farmers found in the study area of the North Gondar Zone. In order to determine the relative contribution of weight gains and price changes to the gross margin was highly determined (Kabirizi et al., 2004).

Challenges and Constraints of Conventional Feeds

The first problems in the production of Agro-industrial by-products is most of the factories which produces various by-products were established round or / and in the town that makes difficult to transport from their place of origin to farmer places and increase transportation cost. The second most constraints was found the by-products specially brewery grains contains high amount moisture that makes difficult to transport from the processing plant to the farming community and individual small holder found nearby district of the area. Third unsuitable issues, if the feed not dried the high moisture contents causes difficult in storage, transportation and handling which limit the regular use of these materials as livestock feed (Kabirizi, 2004).

The other simple but not neglected obstacles to use the Agro-industrial by-products as livestock feed was some of the oil seed cakes was used as fuel for cooking enjera and other foods. The four most constraints the different Agro-industrial by-products has not yet well identified their nutritional values in terms of crude protein, energy, mineral, vitamins and even their fiber contents and nonedible parts in the study area. The other most problems was found to be consider the production potential of each individual factories were very low due to their week competition between the local oil with the imported palm oils and high taxation rate put by the Ethiopian government (Sanford and Ashly, 2008).

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Table 1 - Livestock Population in North Gondar zone (TLU)

Name of district	Cattle	Sheep	Goat	Donkey	Horse	Mules	Camel
Gondar town	192.7	125	108	-	10.4	-	-
Gondar zuria	61.13	10.3	35.9	4.2	10.3	7.58	-
lay armachiho	1036	11.5	15.4	37.95	35.9	0	-
Dembia	1195	61.9	21.1	39.4	23.6	0	-
Wogera	593	220	24.5	27.9	-	15.6	-
Chilga	1479	2.52	0.63	34.192	3.58	0	0.5
Total	4557	431	205	143.64	83.6	23.2	0.5

CSA (2006, - = shows no data.

Table 2 - Grain milling factories and animal feed supply in Gondar town

Name of processing Plant	Yield (qt)	Types of by-Products	Year of establish
Sewlesew beltina wutet grain mill	248972	Bean and pea Bran check pea bran	1998
Tewoderos grain milling factory	98689	Bean & peas barns	1985
Oil milling factory	75896	Noug, SF, GN cakes	1987
Abine grain mill factory	69879	Beans bran	1982
Total feed supply	493436	--	--

Sources: Survey data analysis

Table 3 - Oil extracting factories and by-products in Gondar town

Name of factory (Local name)	Quantity of By-product	Types of by-product	Factory establishment year
Bereka	81016	Noug & GNC	1975
Kibe oil factory	59240	Noug,SF, GNC	1987
Fasil oil factory	28776	Noug and GNC	1985
Mina oil factory	85857	Noug & GNC	1987
Dashen oil factory	62584	Noug,SF, GNC	1985
Kamil oil factory	58136	Noug,SF, GNC	1985
Cotton seed factory	85741	Cotton SC	1990
Abdirkadir & his family edible oil factory	98756	Noug,SF, GNC	1988
Grand Total		560106 quintals	

Sources: ILDP (2002). Key: - GNC= Ground nut cakes, SF= Sun flower, SC= Seed Cakes.

Table 4 - Oil extracting plants and production potential in each district

Name of the districts	Quantity of by-product (Quintal)	Types of by-product produced
G/zuria	26191	NC, SFC and GNC
Dembia	71549	N & GNC
wogera	114818	NC & GNC
L/armachiho	104720	NC, SF and GNC
Gondar town	560106	NC & GNC
Chilga	36918	NC, SF and GNC
Grand Total	914302	

Sources: ILDP (2002). Key: - NGC= Ground nut cakes, SFC= Sun flower cakes, NC= nug cake * = no data.

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CONCLUSION

Suggestion and Recommendations in Future Priorities

The Government as well as any private investors and non-governmental organization should assist the factories by-products to arrive to the smallholder income owning farmers and sold their by-products with a reasonable price through subsidizing the cost so as the those farmers would get a good income and could improve their way of life. The brewery grain should dried the by-products to the standard of livestock feeding practice, so that the feed would have a specific feed ingredients and could clearly give the feed quality information to their customary. The Government should establish farmers' cooperative the way that those farmers and individual small holder would contribute their animal products to the cooperatives according to their quantitative products hence each individual contributor would get a better income by changing the products in different forms of salable products and sold with a better price to their customers. The Government should design and make access to use any alternative electric power to cook their food rather than using any wood materials and various oil seed cakes in the area.

Any factory owners or private livestock investors and other academicians should make analysis on the bases of nutritional values of the different Agro-industrial by-products as they could make a sort of promotion about the quality of their products and would get a better price and income. Each individual factory owners and Government increase the production potential of the by-products through by decreasing and reduced the tax and eradicate value adding tax (VAT) from the food processing industries and reduced importing of palm oils the country respectively. Therefore, the individual factory processor would increase the production potential of the factory.

DECLARATIONS

Acknowledgements

I would like to acknowledge those all the factory owners, factory managers who were actively participated during the interviewing process in the study period. Finally my appreciation goes to the Sustainable Resources Management Program of North Gondar zone (SRMP-NG) for its financial support for this research work.

Authors' Contribution

I contribute on data analysis and the write up of the manuscript and the second authors was participated on data collection and gathering information for this paper.

Conflict of interests

The authors have not declared any conflict of interests.

REFERENCES

ARC (Agricultural Reseach Council) (1984). The protein requirements of ruminant livestock. Agr. Res. Counc., London, England.

Calo II (1997). Supplementary feeding. In: Proceedings of the third Scientific Conference of the Tanzania Soc. Anim. Prod.

Central Statistics Authority (CSA) (2006). Agency, Federal Democratic Republic of Ethiopia Agricultural Sample Survey 2006/07, volume II, Report on livestock and livestock characteristics. Statistical Bulletin 388. Addis Ababa, Ethiopia. pp. 9-10: 25-27.

Hatchson D (2006). Dairy Beef Production Manual. Ethiopian Sanitary and Phytosanitary Energy Agency (IAEA) in Zambia. University of Reading, Reading, United Kingdom.

Food and Agriculture Organization (FAO) (1997). FAO Year book Production. Vol. 51. FAO feed for ruminants: (eds. A.N. said and B. Dzowela). Overcoming constraints to efficient First-and Second-year Calves on Trichostrongylid Infections in Lithuania. Vet.

ILDP (Integrated Livestock Development Program) (2002). A livestock population survey.

Jaetzold R and Schmidt H (2006). Farm Management Handbook of Kenya 2nd Edition.

Kabirizi J, Mpairwe D and Mutetikka D (2004). Testing forage legume technologies with smallholder dairy farmers: a case study of Masaka district, Uganda. Uganda J. Agr. Sci., 9: 914-921.

Lanyasunya TP, Rong H, Abdulrazak SA and Mukisira EA (2006). Effect of Supplementation on Performance of Calves on Smallholder Dairy Farms in Bahati Division of Nakuru District, Kenya. Pakistan J. Nutr., 5.

Lukuyu BA, Kitalyi A, Franzel S, Duncan A and Baltenweck I (2009). Constraints and options to enhancing production of high quality feed in dairy production in Kenya, Uganda and Rwanda. ICRAF Working Paper no. 95. Nairobi, Kenya: World Agroforestry Centre.

Malede B and Mastewal B (2012). Role of Seeding Rates and Cutting Stages on Yield and Quality of forage. LAP Lambert Academic Publishing, Germany. ISBN 978-3-659-25690-5, pp. 47-55.

Methu JN (1998). Strategies for the utilization of maize Stover and thinning as a dry season feed for dairy cows in Kenya. PhD thesis, University of Reading, UK. 298 pp.

Nansen P, Steffan P, Monrad J, Grønvold J and Henriksen SA (1990). Effects of separate and mixed grazing on trichostrongylosis in first- and second-season grazing calves. Veterinary Parasitology, 36(3-4): 265-376.

Owen E and Aboud AAO (1998). Practical problems of feeding crop residues. Plant breeding and the nutritive value of crop residues, (Reed JD, Capper BS, Neate PJH (Eds.) ILCA, Addis Ababa, 133-156.

Sanford J and Ashly S (2008). IGAD Livestock Policy Initiative: Livestock Livelihoods and Institutions in the IGAD region. IGAD LPI Working paper No. 10-08.

Sarkunas M, Nansen P, Hansen JW and Paulikas V (2004). Effects of Mixed Grazing of First- and Second-year Calves on Trichostrongylid Infections in Lithuania. Veterinary Research Communications. Vol 24, Num 2.

Smith T, Manyuchi B and Mikayiyi S (1990). Legume supplement of maize Stover as a Standards and Livestock Meat Marketing Program. Statistics Series No.142. Rome, Italy.

The Tanzania Society of Animal Production. Utilization of agricultural by-products as animal Feed. ILAC, Addis Ababa. Pp. 218-231.

Withman PC, Warding SS, Wallis EC and Brucc R (1990). Tropical Pasture Science. Oxford Univ., London, England, WOA-G (2006).

To cite this paper: Birhan M and Mekuriaw Y. (2018). Review on: assessment of conventional animal feed supply in and around North Gondar zone, Ethiopia. *Online J. Anim. Feed Res.*, 8(2): 33-38. www.ojafr.ir

2018 SCIENCELINE

Online Journal of Animal and Feed Research

Volume 8, Issue 2: 39-45; Mar 25, 2018 ISSN 2228-7701

DAIRY TECHNOLOGY ADOPTION IN SMALL HOLDER FARMER IN AND AROUND GONDAR TOWN, AMHARA REGION, ETHIOPIA

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ORIGINAL ARTICLE
pii: S222877011800006-8
Received 12 Dec. 2017
Accepted 15 Mar. 2018

ABSTRACT: The study was conducted in and around Gondar town Zone of Amhara regional state, North Gondar, Ethiopia to assess the dairy technology adoption practice in small holder farmer. A total of 40 Households (HHs) were randomly selected. Questioner was developed and a survey was conducted on the selected HHs pertaining dairy technology and adoption practice. The gathered data was summarized and analyzed by using SPSS 20. The result revealed that 85 % of respondents do not adopt different dairy technologies.Most of the households in the study area were usingindigenous dairy cattle breeds. The proportion of cattle's owned by respondents were 4.45±2.253, 0.7±2.366 and for indigenous, Exotic and cross breed, respectively. Despite the largest concern was given for male households, females also involved in cow management, milking activities aiming for milk consumption and income generation. Almost all farmers in the study area provided house for cattle, and about 42.5 % of the respondents indicated that loose housing system is widely used in the area. Ration formulation based on scientific standard was not common in the study area. From the interviewed households, 50 % of respondents were practicing mixing of different feed stuffs which is taken as formulation. All of the households in the study area neglects urea molasses block making and silage making technologies. In general the level of technology adoption by smallholder farmers is still unsatisfactory. Therefore, the government and extension agent should give emphasis on improving dairy technology and its adoption in small holder farmer though continuous training on how to utilize improved feeding, artificial insemination, improved housing and health care technologies.

Keywords: Adoption, Dairy Cattle, Smallholder, Technology

INTRODUCTION

Dairy development in developing countries has played a major role in increasing milk production, improving income level in rural areas, generating employment opportunities and improving the nutritional standards of the people especially for small and marginal farmers (Uddin et al., 2010). Ethiopia has large cattle population estimated at 56.71 million heads out of which 98.66 percent of the total cattle in the country are local breeds (CSA, 2015). The remaining are hybrid and exotic breeds that accounted for about 1.19 percent and 0.14 percent, respectively (CSA, 2015). In Ethiopia, dairy production is mainly of subsistent type largely based on indigenous breeds of cattle. Currently, demand for dairy products in the country exceeds supply, which is expected to induce rapid growth in the dairy sector (Haese et al., 2007). The factor which contributed to the demand is increased urbanization and expected growth in incomes (Ahmed et al., 2004). Thought the country has one of the largest livestock populations in Africa, per capita consumption of milk (17 kg per year) is much lower than the average for Africa (26 kg per year) (Alemu et al., 2000). The dairy technologies encompass the use of crossbred animals, improved feed technology and improved management (Mohamed et al., 2004). The dairy sector in the Ethiopian highlands is characterized by subsistence oriented production, low use of technological inputs and underdeveloped markets for inputs, services and outputs (Ahmed. et al., 2004). The use of improved cross breed cows is limited and about 81% of the total annual milk production is accounted by low yielding indigenous cattle (FAOSTAT, 2014). Most development and

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research projects in dairying where conducted within and/or around Addis Ababa milk shed (Yigrem et al., 2008). In and Around Gondar town, the practical application of dairy technologies like feeding, breeding and artificial insemination and the constraints associated with its application were not investigated by researchers. Since the above factors have not been studied in the study areas; there was a need to assess dairy technology adoption by smallholder farmer. Therefore, this study were undertaken to assess the dairy technology adoption practice in small holder farmer for fill the existing information gap in the area.

MATERIAL AND METHODS

Description of the study area

The study was conducted in and around Gondar Town, the capital of North Gondar administrative zone, is located in Amhara national regional state 738 km away from Addis Ababa, the capital city of Ethiopia, in the North West direction. The town is found at latitude of 12.3-13.8°N, at a longitude of 35.3-35.7°E and at 2200m a.m.s.l. The annual mean minimum and maximum temperature of the area vary between 12.3-17.7°c and 22-30°c respectively with an annual average temperature of 19.7°c. The region receives a bimodal rainfall, the average annual precipitation being about 1000mm that comes from the long and short rainy seasons. The short rainy season occur during the months of March, April and May and while the long ones extend from June to September (CSA, 2015).

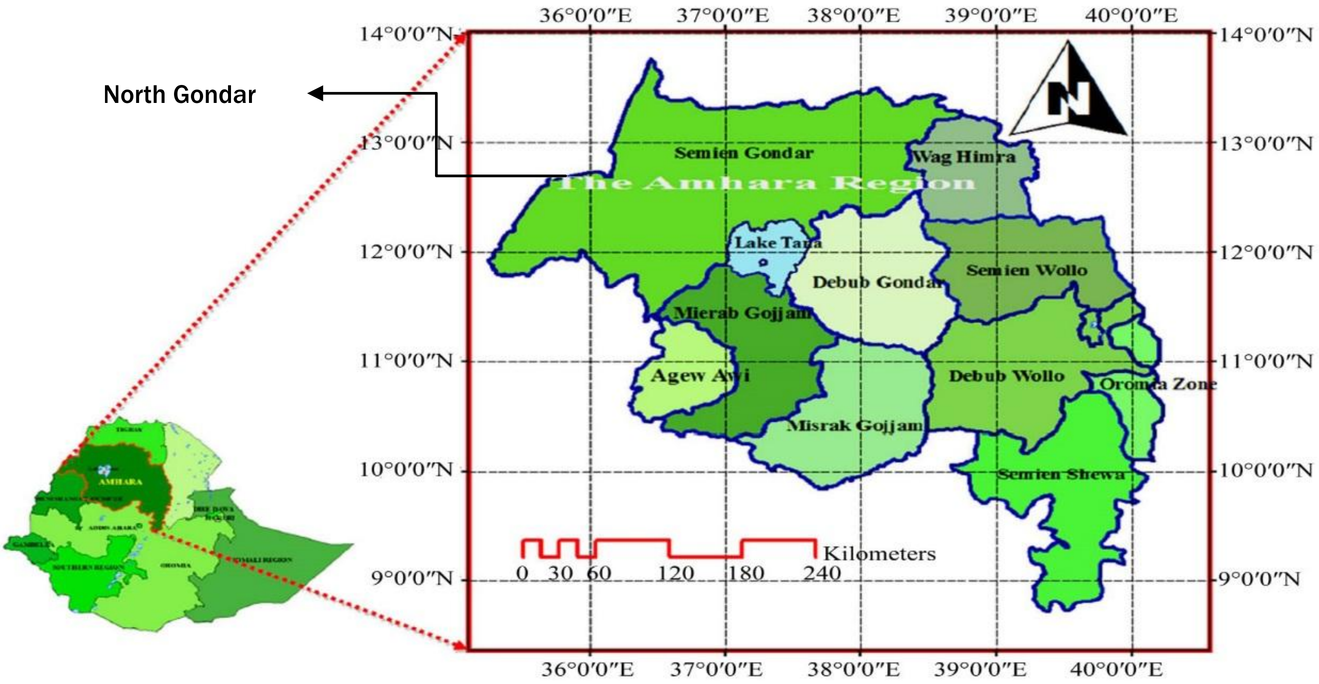

Figure 1 - Map of the study area

Study design

A cross- sectional study was conducted to address this research aim. The primary data had been collected from household survey through semi-structured questionnaires and observation. Annual reports of the Keble, books and magazine were used as a secondary data sources. Data were check for accuracy and coded.

Sampling methods and sample size

The study was conducted in Gondar district particularly with in four PAs were selected randomly from the whole peasant association (PAs). Finally ten households were selected purposively from each PAs based on the presence of dairy farmers to achieve reliable data.

Statistical Analysis

The processed data were analyzed by using statistical package for social science (SPSS version 20). Descriptive statistics such as percentage, mean, were used to analyze the data quantitatively and it was presented using tables and figures. On the other hand, the data gathered through personal observation was organized according to them and analyze qualitatively to strengthen data obtain from house hold survey.

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RESULTS AND DISCUSSION

Demography, occupation and education level of the respondent

Sex, Age group, marital status, occupation, educational background and religion of the respondents in the study area are presented in Table 1. In the study area, the majority of households were male headed (75.5%) while the rest (25.5%) were females. In line with this, Tesema et al. (2009) found that about 91.11%, 8.89% were male and female who involved in dairy production respectively in his study. In contrast to this, according to the study conducted in Dejen district, female participants in dairy production were lower (35 %) (Mekonnen et al., 2006). The majority (45%) of the respondents in the study area were found to be literate (6-12), and only small proportion (17.5% of households were illiterate. The religion of 95.5% of respondents was orthodox and the reaming 2.5% were Muslim.

Purpose of keeping dairy cows

The main aim of producing dairy cows in the study area is for milk production which accounts 65% and the rest 35% of households produce cows for sale as income generation (Figure 2). In Agreement with this finding, Gebrekidan et al. (2012) indicated that the aim of dairy production in Tigray region was for milk production which accounts 50 % followed by saving as a live animal which accounts 48%, respectively.

Cattle ownership in the study area

The mean livestock holding in the study area are given in Table 2. The average number of livestock population per house 10.83 ±4.54 animals. This result is relatively higher than results reported by Chanie et al. (2015) who indicated that the average cattle number per household in Enebse Sar Mmidir district is 4.43±0.19. Among cattle groups assed in the study area, 2.10±2.352, 0.7±2.366 and 4.45±2.253 was the proportion of cross breed, exotic breed and indigenous breed, respectively. Indigenous breeds which are known with their low productive and reproductive potential are dominant than other improved dairy breeds in the study area. Typical indigenous and cross breed cows while they are in feeding situation is shown in Figure 3.

Technology adoption rate

The proportion of dairy technology adoption and reasons for resistance to technology adoption is presented in Table 3. Most small holder farmers were non adopter in technology adoption 85% and the remaining 15% adopter. A large number of dairy farmers are almost ignorant about improved technology practices and the production system by most of the household is yet traditional. In line with this, Adopters of all improved breeding, feeding, and housing systems achieve improved dairy production than do non-adopters this supported in US (Khanal et al., 2010).

Housing of Dairy Cows

Type of house and housing management of dairy cattle in and around Gondar Town is presented in Figure 4. About 42.5% of the respondents reported to have loose house and about 40% of tie stall, 17.5% of free stall house.

Table 1. Demographic characteristics of households in the study area

Variables	Categories	Frequency	Percent (%)
Sex	Male	29	75.5
	Female	11	25.5
Age	19-65	35	87.5
	Above 65	5	12.5
Marital status	Single	9	22.5
	Married	25	62.5
	Widowed	6	15
Occupation	Farmer	14	35.0
	Student	2	5
	Trader	16	40
	Unemployed	4	10
	Employee	4	10
Education level	Illiterate	7	17.5
	Literate(1-6)	14	32.5
	Literate(6-12)	18	45
	Literate university	1	2.5
Religion	Orthodox	39	97.5
	Muslim	1	2.5
Total		40	

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Figure 2. Purpose of keeping dairy cows

Table 2 - Cattle ownership in study area

Cattle Types	Mean	Standard deviation
Number of cross breed	2.10	2.351
Number of exotic breed	0.7	2.366
Number of indigenous breed	4.45	2.253
Number of bulls	0.82	1.01
Number of calves	2.78	0.92
Total number of cattle	10.83	4.54

Figure 3 - Typical indigenous and cross breed cows in the study area

Table 3 - Technology adoption by households

Variables		Frequency	Percent (%)
Technology adoption	Adopters	6	15
	Non adopters	34	85
Reason for resistance to TA	Lack of awareness	6	17.6
	Lack of extension agent	14	41.17
	Lack of resource	4	11.76
	All	10	29.41

TA = Technology adoption

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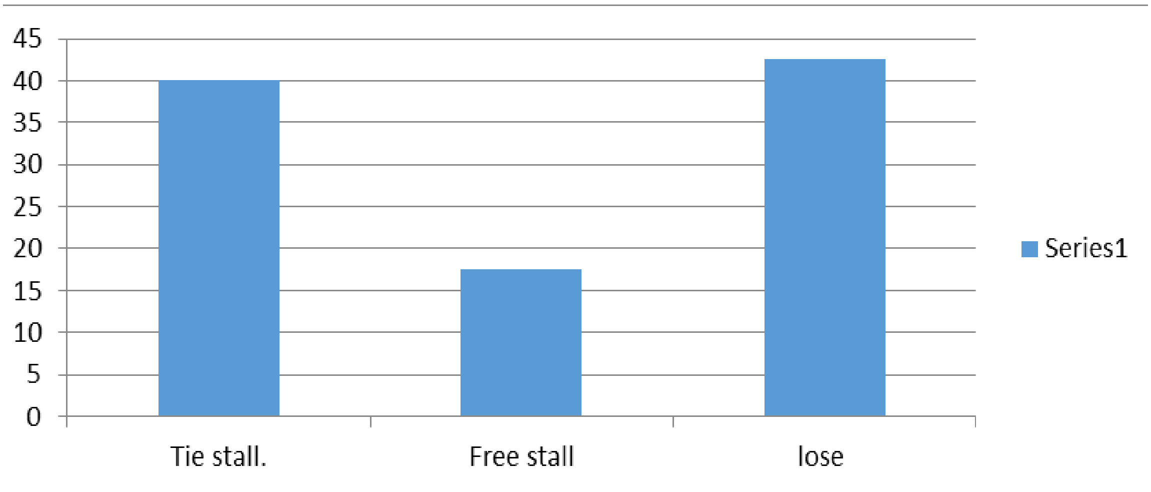

Figure 4 - Types of housing

Breeding Practice of Dairy Cows

The application of artificial insemination technology for improving the reproductive and productive performance of cows in the study area is still low the level of technology adoption by smallholder farmers is still unsatisfactory. Most of the smallholder farmer 57% uses natural mating, 20%use artificial insemination and the remaining 22.5% used both natural mating and artificial insemination. Similarly, application of important dairy technologies like AI, Improved forage development and vaccination of animals was found to be low in the previous studies conducted in Kenya and Ethiopia (Kebebe et al., 2016). Provision of veterinary service and artificial insemination technologies in Ethiopia is very limited and the system is very poor (Ayele et al., 2012; Tegegne et al., 2010).

Feeds and Feeding System of Dairy Cows

The result of feeding system in the study area is indicated in Table 5. Among interviewed households, 17.5% of the respondents have experience on growing improved forage around their home while adoption of different varieties of forage is not practiced by the majority (82.5 %) of the households in the study area. Mixing of different feedstuffs which is considered as ration by households was practiced by 50% of respondents. But the ration might not be in line with scientific standard as it misses nutrient values of feeds and the requirement of the animals, it is done by estimation. Physical treatment of feeds like cooping was found to be the most (92.5%) common practices by households in the study area but treating feeds by chemicals like urea was not totally adopted by farmers. The urea molasses block making as a mineral supplement for improving the performance of animal was totally ignored by households in the study area. Silage making as a mechanism for feed conservation was not also adopted by all farmers in the study area. Free grazing with supplementation of some feeds at night and morning was found to be common in the study area.

Major Constraints of Dairy Technology Adoption

The major constraints of dairy technology adoption on housing, feeding and breeding are presented on Figure 5. The major constraint of adopting scientific knowledge regarding housing was lack of land (35%), lack of knowledge (30%) and lack of suitable well drained site. In line with this result lack of land for dairy production activities was mentioned as a major constraint of dairy production in Jimma town of oromia region (Belay, 2011). On the other hand, the major problem of adopting breeding technologies were lack of extension service and knowledge to detect heat and to inseminate animals (37.5%), and inability to support the fetus (40%) were the two major constraints. The major problems concerning on feeds and feeding technologies were shortage of land for growing forages (32.5%), lack of feed access from government (30%), high price of concentrated feed to formulate balanced ration (20%) were the three major constraints. In line with this, Asaminew and Eyasu (2009) reported that the major problem in feeds and feeding of dairy cow in Bahirdar Zuria and Mecha district is lack of feeds which accounts 38.9 % from the respondents. According to our findings, there are so many factors that affect dairy technology adoption. The major problem in all aspects of dairy technology adoption lies on lack of awareness (Knowledge) which is the result of poor extension service by experts. In line with this finding, Chagunda et al. (2006) reported that lack of knowledge was one of the main reasons for not adopting performance recording in smallholder farms in Malawi.

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Table 4 - Forage development, feeding system and feed treatment practice			
Indicators		**Frequency**	**Percent (%)**
Experience on Growing of improved forage		7	17.5
Give formulated ration for dairy cows and calving cows		20	50
Ration formulation basis	Based on body weight	3	7.5
	Based on breed	3	7.5
	Based on age	2	5
	Randomly	12	30
Feed treatment	Physical treatment	37	92.5
	Chemical treatment	37	92.5

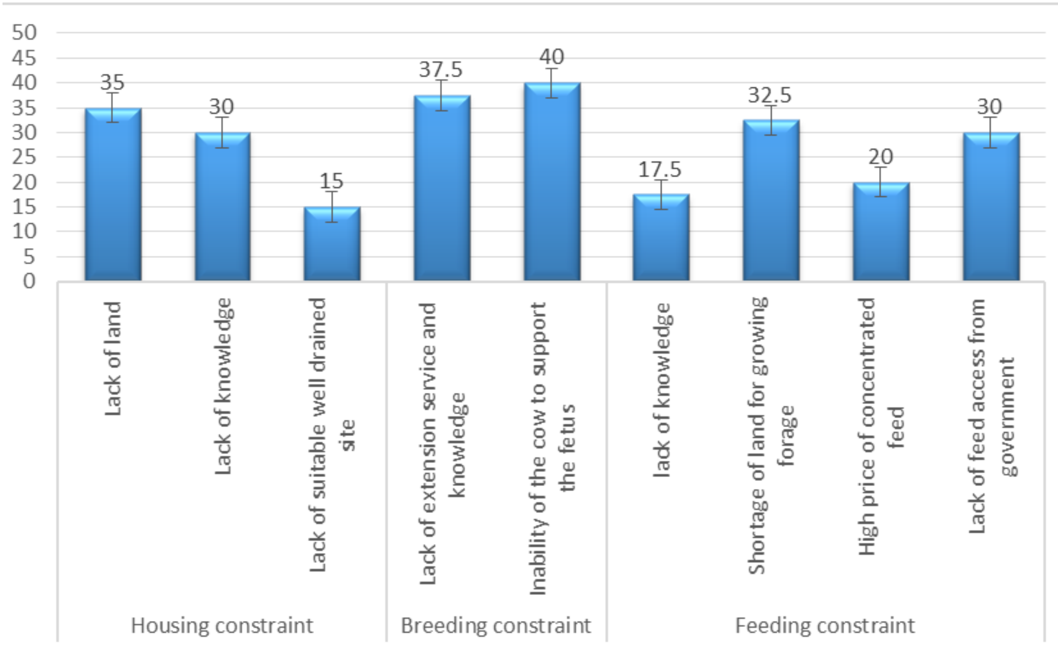

Figure 5 - Major constraints of dairy technology adoption.

CONCUSION AND RECOMMENDATION

It could be concluded that the level of technology adoption related with feeding technologies, Breeding technologies, better housing, health care activities by smallholder farmers is still unsatisfactory. Especially implementation of urea molasses block technology as a supplement to improve milk productive performance of cows is neglected by farmers in the area. Besides, the practice of improved forage development strategies and treatment of feed is also very low in the area. The main reasons for resistance according to the respondents were lack of knowledge, extension service, and limited resource. Among the technologies observed in the area keeping of cows independently in Tie stall housing system was found to be better compared to other technologies. Among the constraints in the study area, Lack of knowledge was found to be the common hindering factor for adoption of dairy technologies related with housing, feeding and breeding. The knowledge gap on advantages of technologies could be a major problem for the loss of interest by small holder farmers for accepting new technologies related with dairy improvement in the study area. Introducing different dairy technologies should be supported with a continuous training or technical backup on how to manage and utilize the technology as well. Dairy technology input and/or service providers should undertake follow ups to identify possible problems and/or evaluate the use and benefits of the interventions.

DECLARATIONS

Acknowledgements

The authors would like to thank smallholder dairy farmers in and around Gondar for providing valuable information to the work.

Author's Contribution

All authors contributed equally to this work.

Competing Interest

The authors declare that they have no competing interests.

REFERENCE

Ahmed, MM, BezabihEmana MA, Jabbar F, Tangka and Ehui S (2004). Economic and nutritional endometritis in repeat breeder dairy cows. Theriogenology 74 (7): 1271-1278.

Asaminew and Eyasu (2009). Smallholder dairy system and emergency of dairy cooperatives in Bahir dar Zuria and Mecha Wore das, northern, Ethiopia. World J. Dairy and Food Sci., 4(2): 185-192.

Ahmed MM, Ehui S, and Assefa Y (2004). Dairy development in Ethiopia. Socioeconomics and Policy Research Working paper 58. ILRI (International Livestock Research Institute) Nairobi.Keneya.47P.

Alemu GW, Aemayehu M, Sendros D, Seyoum B, and Alemu T (2000). Status of dairy research in Ethiopia. In: Proceeding of a workshop on the role of village dairy co-operatives in dairy development: prospects for improving dairy in Ethiopia, SDDP, MoA, Addis Ababa, Ethiopia

Ayele S, Duncan A.J, Larbi A. and Truong K T (2012). Enhancing innovation in livestock value chains through networks: Lessons from fodder innovation case studies in developing countries, Science and Public Policy, 39, 333–346

Belay D, Yisehak K, Geert PJJ, (2011). Analysis of constraints facing urban dairy farmers and gender responsibility in animal management in Jimma Town. Af J Basic Appl Sci.; 3:313–318.

Chagunda M G G, Msiska A C M, Wollny C B A, Tchale H and Banda J W (2006). An analysis of smallholder farmers' willingness to adopt dairy performance recording in Malawi. *Livestock Research for Rural Development. Volume 18, Article #66.* Retrieved December26,2017, from http://www.lrrd.org/lrrd18/5/chag18066.html

Central Statistical Agency (CSA) (2015). Agricultural sample survey. Report on livestock and livestock characteristics. The Federal Democratic republic of Ethiopia, Central Statistical Agency (CSA). Private Peasant Holdings. Statistical Bulletin 578 Addis Ababa, Ethiopia, March, 2015

Chanie D, Mekuriaw Z, Taye M (2015). Husbandry Practices and Pre-Weaning Growth Performance of Goats. first edited by Scole; LAMBERT Academic Publishing., ISBN: 978-3- 659-80220-1

FAOSTAT (2014). FAOSTAT database. Food and Agriculture Organization of the United Nations, Rome, Italy.

Gebrekidan TW, Zeleke M Gangwar SK (2012). Socio-economic characteristics and Purpose of keeping dairy cattle in Central zone of Tigray, Northern Ethiopia. I.J.A.B.R., VOL. 2(2) 2012: 256-265

Haese M D Francesconi G N and Ruben R (2007). Network management for dairy productivity and quality in Ethiopia Development Economics Group, Wageningen University, Hollandseweg 1, 6706 KN, Wageningen, The Netherlands.

Kebebe EG, Oosting SJ, Baltenweck I, and Duncan AJ (2017). Characterization of adopters and non-adopters of dairy technologies in Ethiopia and Kenya. Trop Anim Health Prod, DOI 10.1007/s11250-017-1241-8

Khanal AR, Gillespie J and MacDonald J (2010). Adoption of technology, management practices, and production system in US milk production. J. Dairy Sci. 93: 6012-6022.

Mekonnen H, Dehninet G, Kelay B (2009). Dairy technology adoption in small holder farms in 'Dejen' District, Ethiopia. Published online 9/8/09 @ springer science +Business media.

Mohamed AM, Ahmed SE and Yemesrach A (2004). Dairy development in Ethiopia. EPTD discussion paper No. 123, International Food Policy Research Institute, Washington, DC, USA.

Tegegne A, Gebremedhin B, and Hoekstra D (2010). Livestock input supply and service provision in Ethiopia: Challenges and opportunities for market-oriented development. 2010, (International Livestock Research Institute, Nairobi, Kenya)

SPSS, 2015 (Statistical Package for Social Science for Window), Version 20.0.

Yigrem S, Beyene F, Tegegne A and Gebremethin B (2008). Dairy production, processing and marketing system of Shashemene- Dilla area. South Ethiopia.

Uddin MM, Sultana MN, Ndambi OA, Hemme T and Peters KJ (2010). A farm economic analysis in different dairy production systems in Bangladesh. Livestock Research for Rural Development. 22: 122.

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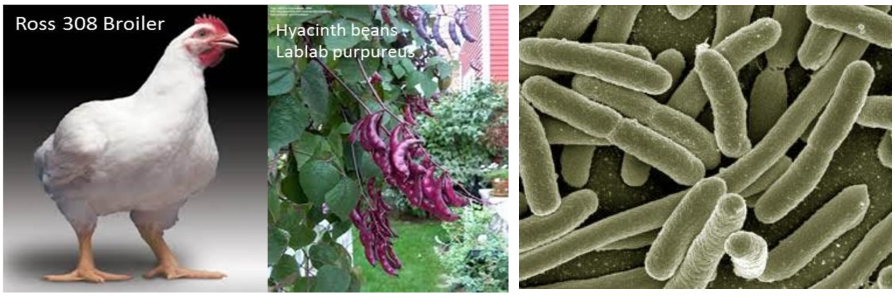

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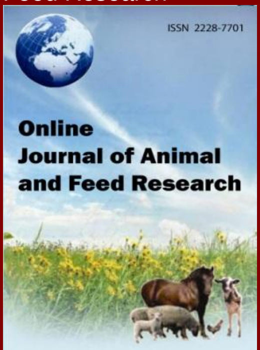

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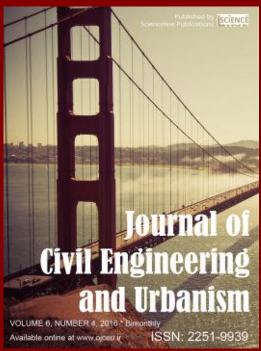

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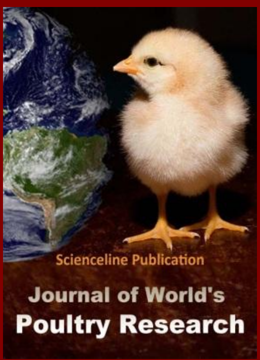

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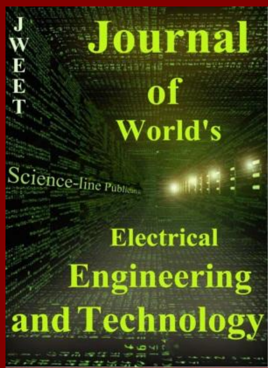

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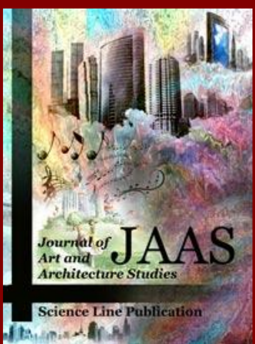

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