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Full Length Research Paper

Effect of Replacing Conventional Ration by Cafeteria leftover on Performance of Ross 308 Broiler Chicken

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Abstract
The study was conducted to evaluate the replacement value of dried cafeteria leftover (DCLO) for conventional ration on performance of Ross 308 broiler chickens at Dilla University poultry farm. Twenty Ross 308 broiler day old chicks were randomly distributed to four dietary treatment groups in a completely randomized design each with three replicates. The experimental rations were (100% pelleted concentrate(Control), 67% pelleted concentrate + 33% DCLO with soy meal, 33% pelleted concentrate + 67% DCLO with soy meal, and 100% DCLO with soy meal) represented as T1, T2, T3 and T4, respectively. The feeding trial was started after an adaptation period of two weeks to the experimental pens and diets. The results showed that DM, CP, CF, ME and Ca intake of birds fed on sole DCLO with soy meal were lower ($p<0.05$) than those fed on diets with pelleted ration. Body weight gain, average daily gain and nutrient efficiency ratio and major carcass cuts weight of chickens fed on sole DCLO with soy meal were also lower ($p<0.05$) compared to diets with pelleted ration. Conversely, mortality was higher on chicks fed on sole non-conventional diet compared to those fed on mixture of conventional and non-conventional diets which might be attributed to inadequate nutrient intake compounded with some hygienic problem. In the present experiment sole non-conventional diets (DCLO with soy meal) showed lower broiler performance, despite the difference in the feed forms. Thus, it was concluded that DCLO with small inclusion of soy meal replaced pelleted concentrate ration up to 33%. However, DCLO can better replace the energy feed ingredients in poultry ration with small inclusion of protein source feed and can be an alternative feed source particularly in and around town poultry farming where the resource is abundantly available.

Key words: *Dried cafeteria left-over; Pelleted ration; Ross 308 Broiler chickens; nutrient intake; growth performance; mortality; carcass trait.*

Introduction

Poultry production plays an important socio-economic role in developing countries like Ethiopia. They provide major opportunities for increased protein supply and income for smallholder farmers as well as the town community (Salam, 2005). Furthermore, they have comparative advantages over ruminants in their faster rate of reproduction, growth and fertility. Moreover, poultry are cheap sources of animal protein as compared to mutton, beef and pork (Amsalu *et al*., 2004). The total chicken population in Ethiopia is estimated to be 56.87 million (CSA, 2015). With these potential, the performance level is reported to be lower than the expected because of various reasons. Among the most important and properly cited ones are inadequate and inconsistent quality and quantity of feed supply, disease and poor husbandry and management practices. It has been widely reported that appropriate nutrition is a pre-requisite for improving poultry production and resistance against disease (Alemu and Tadelle, 1997).

Poultry nutrition mainly dependent upon cereal grains; However, there is strong competition for cereals with human beings and the production of cereals hardly keeps pace with alarming human population growth. Moreover, the prices of these conventional feed resources have soared so high that it is becoming uneconomical to use them in poultry feeds especially under the poor smallholder conditions (Opara, 1996; Esonu *et al*., 2001). Therefore, it is a must to look for non-conventional feed resources which are cheap and locally available, particularly those that have complementary effect to human health and nutrition. Among the non-conventional feedstuffs that have been evaluated for use in the compounding of livestock and poultry rations are by-products from food processing industries and food leftover which recognized to have nutritional values enough to be used as feed resource for broiler and laying hens (Soliman *et al*., 1978; Hoshii and Yoshida, 1981; Westendorf *et al.* 2000; Chen *et al*., 2007 and Tamasgen, 2015). Recycling cafeteria food leftover into livestock feed ingredient have a potential to minimize livestock feed cost as well as protecting the environment against pollution derived from the leftover (Sim, 1998). The leached from cafeteria leftover has a potential to pollute the water, air and soil because of their high moisture content. Converting and recycling of leftover food into animal feed are very important because leftover food can contribute to not only decreasing cost of feed ingredients but also decreasing environmental pollution (Yang *et al*., 2001). In Ethiopian higher education, cafeteria food leftover is increasing with the increasing number of enrolled students year after year which has been mostly wasted and could be an environmental threat that otherwise been used for livestock feeding. Many researchers reported the potential value of food leftover for different breeds of livestock with different feeding regimes. However, the

replacement value of University cafeteria leftover for conventional ration on performance of Ross 308 broiler chicken in Ethiopian condition yet not investigated. Therefore, this research project was computed to evaluate the feeding value of students' cafeteria leftover as a replacement for conventional ration on the performance of Ross 308 broiler chickens under tropical environment.

Materials and Methods

Description of the Study Area

The experiment was conducted at Dilla University poultry farm, placed in Dilla town 365 km south of the capital city Addis Ababa and 85 km south of the regional city Hawassa. The area located at 38° 30'E longitude, 6° 27'N latitude with an average altitude of 1625m above sea level. Rainfall is bi-modal and ranges between 1200 and 1800 mm. The minimum and maximum temperature ranges between 18 ^{0}C and 25 ^{0}C.

Experimental Animals and their Management

The deep litter experimental house was prepared, cleaned and disinfected before the introduction of experimental birds. A total of 300 Ross 308 unsexed day old broiler chicks were purchased from ELFORA Poultry Farm. Chicks were vaccinated against Newcastle and Infectious Bursal Diseases (*Gumboro*) on the 7th and 12th days, respectively. The chicks were acclimatized to the environment and fed a starter ration for the first two weeks. Twenty chicks were then randomly assigned to each of the three replicates of the four treatment diets. Measured amount of feed was offered to birds each day. Daily feed offer was 10% more than intake of the previous day and fresh clean water was available at all times. Daily feed refusals in each replicates was collected, weighed and recorded at 8:00 AM before the daily feed was offered. Mortality was recorded from beginning until the 7th weeks. Body weight was recorded at the beginning of the experiment and subsequently on a weekly basis. Weighing of the chicks was carried out in the morning between 7:00 and 9:00 AM before the daily feed was offered. Weight gain, nutrient intake, nutrient efficiency ratios and mortality rate were calculated.

Experimental Feeds Preparation

The conventional pelleted ration was purchased from Alema Koudijus at Debre Zeit feed processing center and the food leftover from the University cafeterias were collected, air dried and bulked together to the required amount. The dried cafeteria food left-over was grinded to smaller size to be taken by chickens and stored in dry shade. Defatted Soybean meal was purchased from Addis Ababa Health Care P.l.c. and formulated with dried and grinded cafeteria leftover to keep Iso-nitrogenous in all treatments.

Experimental Design and Treatments

The experimental design used was completely randomized design involving four different treatment rations with three replications. The rations contain dried cafeteria food leftover and soy meal at replacement rate of 0, 33, 67 and 100% for pelleted concentrate ration and are represented as T1, T2, T3 and T4, respectively. The layout of the experiment is shown in table 1.

Table 1. Layout of the Experiment

Treatments	Replicates	Chicks per Replicate
T_1 = 100% Pelleted ration (control)	3	20
T_2 = 67% Pelleted ration + 33% DCLO and soy meal	3	20
T_3 = 33% Pelleted ration + 67% DCLO and soy meal	3	20
T_4 = 100% DCLO and soy meal	3	20

DCLO= Dried Cafeteria Left-over

Chemical Analysis of Feeds

Feed samples were analyzed for dry matter, ether extract, crude fiber and ash content according to AOAC (1990). Nitrogen content of the feed was determined using Kjeildhal procedure. CP value was determined by multiplying the nitrogen value with 6.25. Atomic Absorption Spectrophotometer method for Calcium was used. Metabolizable energy (ME) of the experimental diets was determined according to Wiseman (1987) as follows: ME (Kcal/kg DM) = 3951 + 54.4 EE - 88.7 CF - 40.8 Ash

Carcass Trait

At the end of the feeding trial 5 broilers from each replicate were randomly selected, tagged and isolated from the pen and starved for 12 hours. Each bird was weighed and killed immediately by severing the jugular vein. The body was scaled in hot water for a minute to pluck the feather and all dissection was carried out. Eviscerated weight, dressing percentage on eviscerated weight base and on all edible carcass weight base, weight of major cuts (thigh/drumstick, breast, back, wings, abdominal fat, weight of total edible offals (Gizzard, liver and skin) and total non edible offals (blood, feather, shank & claw, head, lungs, heart, spleen, pancreas, digestive, urogenital parts) were weighed and calculated.

Statistical Analysis

The data collected were analyzed as per completely randomized designs by employing GLM ANOVA procedure using Statistical Analysis System (SAS, 2008) version 9.1.3 computer software program. The significant difference among treatment means were tested by Duncan's Multiple Range Test (DMRT). All statements of statistical differences were based on $p<0.05$.

The model for the data analysis was: $Y_i = \mu + T_i + E_i$

Where;- Yi - is the response variable, μ - is the overall mean, T_i - is the treatment effect, E_i - is the random error.

Results

Nutrient Composition

The nutrient composition of the experimental diets displayed in Table 2. The CP content of conventional pelleted ration was higher than the requirement of the chickens specified by the feed manufacturer. Crude protein content of dried cafeteria leftover (17.46%) was slightly under the supplementary range. Dried cafeteria leftover had lower CF and EE content than the other feed stuffs. Conversely, ME content of cafeteria left-over was higher than the conventional rations.

Table 2. Chemical composition of feed stuffs used in the experiment

	Chemical Composition (DM bases)						
Feed stuffs	DM%	CP%	EE%	Ash%	CF%	Ca%	ME Kca/Kg
Starter Pellet Ration	92.57	28.27	4.35	4.44	4.97	2.34	3565.65
Grower Pellet Ration	92.4	24.81	4.12	5.88	5.19	1.44	3474.87
Finisher Pellet Ration	92.9	24.68	4.03	4.88	4.74	2.69	3550.69
Soybean Meal	94	37.4	12.6	6.3	5.9	2.1	3856.07
Cafeteria Left-over Meal	90.4	17.46	2.35	3.76	1.33	2.03	3807.46

DM = dry mater; CP = crude protein; EE = ether extract; CF= crude fiber; Ca = calcium; ME = metabolizable energy, kcal = kilocalorie; kg = kilogram.

Nutrient Intake

Table 3 shows the daily mean nutrient intakes of Ross 308 chicks fed different levels of cafeteria left-over replaced for formulated pelletized ration. DM, CP, CF, ME and Ca intake were significantly ($p<0.05$) higher in all treatments except in sole cafeteria left-over and soy meal (T_4). There was no significant difference between the control diet (T1) and T3 on DM and CP intake. The CF intake showed linear increase with increasing levels of formulated pelletized ration.

Table 3. Mean daily nutrient intake of Ross 308 broiler chicks fed different level of cafeteria left-over as a substituent for formulated pelleted ration.

Variables	**Treatments**					
	T_1	T_2	T_3	T_4	SEM	P
Intake (g/day)						
DMI (g/chick/day)	123.6^{ab}	125.1^{a}	117.8^{b}	63.13^{c}	11.41	<0.01
CPI (g/chick/day)	30.3^{ab}	31.01^{a}	29.23^{b}	15.68^{c}	0.47	<0.01
CFI (g/chick/day)	6.2^{a}	5.46^{b}	4.34^{c}	1.91^{d}	0.02	<0.01
MEI (kcal/chick/day)	410.9^{b}	451.48^{a}	460.21^{a}	235.72^{c}	142.3	<0.01
CaI (g/chick/day)	2.38^{a}	2.43^{a}	2.36^{a}	1.29^{b}	0.01	<0.01

Means between treatment diets in the same row with different superscript letters are significantly ($p< 0.05$) different; DMI=Dry matter intake; CPI=Crude protein intake; CFI=Crude fiber intake; MEI=Metabolizable Energy intake; CaI=Calcium intake; S.E.M=Standard error of means.

Body Weight Gain

The average body weight, body weight gain, feed efficiency ratios and mortality rate of Ross 308 chicks fed different levels of cafeteria left-over replaced for formulated pelletized ration are presented in Table 4. The body weight gain and average daily gain of chicks fed non-conventional diet alone was significantly ($p<0.05$) lower than those fed on mixture of conventional and non-conventional diets. However, T1 and T2 showed significantly ($p<0.05$) superior weight gain than those on T3 and T4.

The FER and PER of chicks fed sole non-conventional diet (T4) was significantly ($p<0.05$) lower than those on the other mix diets. There was no significant difference on FER and PER between T2 and T3. Mortalities were significantly higher (($p<0.05$) on chicks fed sole non-conventional diet (T4) than those fed on mixture of conventional and non-conventional diets; however, significant difference did not observed among chicks fed diets from mixture of conventional and non conventional sources.

Table 4. Body weight gain, nutrient efficiency ratio and mortality rate of Rose 308 chicks fed different level of cafeteria left-over replaced for formulated pelleted ration.

Variables	Treatments					
	T_1	T_2	T_3	T_4	SEM	SL
Initial body Wt. (g)	325.7^{a}	322.3^{a}	294.8^{a}	354.6^{a}	2377.4	0.55
Final body Wt. (g)	3248.1^{a}	3127.0^{a}	2771.4^{b}	1393.1^{c}	17779.3	<0.01
Av. weight gain (g)	2922.5^{a}	2804.6^{a}	2476.7^{b}	1038.6^{c}	11685.2	<0.01
Av. daily gain (g)	67.965^{a}	65.224^{a}	57.6^{b}	24.2^{c}	6.31	<0.01
FER (%)	0.55^{a}	0.52^{ab}	0.49^{b}	0.38^{c}	0.00	<0.01
PER (%)	2.24^{a}	2.10^{ab}	1.97^{b}	1.54^{c}	0.01	<0.01
Mortality (%)	13.33^{a}	20.28^{a}	20.67^{a}	28.33^{b}	72.05	<0.05

Means between treatment diets in the same row with different superscript letters are significantly ($p<0.05$) different; FER= Feed efficiency ratio; PER= Protein efficiency ratio; SEM= Standard error of means.

Carcass Trait

Table 5 presents the carcass traits of Ross 308 chicks fed different levels of cafeteria left-over replaced for formulated pelletized ration. Slaughter, eviscerated, breast, back, wings and abdominal fat weight of chicks fed on diets from conventional and non-conventional mix was significantly higher ($p<0.05$) than those on non-conventional alone (T4). Chicks fed on non-conventional diets (T4) showed significantly lower ($p<0.05$) value in most of the carcass traits. There was no significant difference ($p>0.05$) on slaughter, eviscerated, thigh and drumstick, breast, back, wings and weight of abdominal fat of chicks fed on T1 and T2. Weight of TEO and TNEO were also similar among chicks fed on conventional and different level of conventional and non-conventional mix diets. Dressing % on the basis of commercially used (Eviscerated) carcass and weight of abdominal fat was higher ($p<0.05$) on chickens fed higher proportion of conventional diet (T1 & T2).

Table 5. Carcass traits of Rose 308 broiler chicks fed different level of cafeteria left-over as a substituent for formulated pelleted ration.

Variables	Treatments					
	T_1	T_2	T_3	T_4	SEM	SL
Slaughter Wt. (g)	3300.3^{a}	3244.4^{a}	3008.3^{b}	1386.2^{c}	12498.7	<0.01
Eviscerated Wt. (g)	1924.4^{a}	2018.4^{a}	1709.5^{b}	741.8^{c}	8607.5	<0.01
Dressing %*	58.33^{b}	62.19^{a}	$56.82b^{c}$	53.44^{c}	3.93	<0.01
Dressing (%)**	71.23^{ab}	74.62^{a}	69.34^{ab}	66.9^{b}	8.79	<0.05
Thigh/drumstick (g)	652.7^{ab}	676.8^{a}	609.6^{b}	256.7^{c}	1096.98	<0.01
Breast (g)	786.7^{a}	850.5^{a}	672.6^{b}	282.67^{c}	2006.29	<0.01
Back (g)	257.6^{a}	260.5^{a}	234.5^{b}	107.4^{c}	570.12	<0.01
Wings (g)	227.4^{a}	230.6^{a}	192.9^{b}	95.08^{c}	252.48	<0.01
Abdominal Fat (g)	88.7^{a}	93.06^{a}	67.9^{b}	9.3^{c}	111.54	<0.01
TEO (g)	425.1^{a}	402.3^{a}	376.9^{a}	186.4^{b}	1060.3	<0.01
TNEO (g)	950.8^{a}	823.8^{a}	921.8^{a}	458.0^{b}	9189.47	<0.01

*Means within the same rows with different superscripts are significantly different ($p\leq0.05$) Where TNEO= total non edible offal, TEO= total edible offal, *= Dressing % calculated on the basis of commercially used (Eviscerated) carcass, **=Dressing% calculated by including edible offal (skin, gizzard and liver).*

Discussion

Nutrient Composition

The analyzed CP content (24.8%) of conventional pelleted ration for grower and finisher was higher than the requirement of the chickens (21%) and (19%) set and analyzed by the feed manufacturer and also higher than recommended by Scanes *et al.* (2004) which was 20% and 18.5% CP for grower and finisher broilers, respectively. Crude protein content (17.46%) of dried cafeteria left-over in the present study was higher than (9.02%) reported by Temesgen (2015) and Amene *et al.* (2015) at Haramaya University. Moreover, Chen *et al.* (2007) reported slightly lower CP content (15.79%) of dehydrated food west product compared to cafeteria left-over in the present study. Conversely, the crude protein content of dried cafeteria left-over in the present experiment was lower than 20-28% reported by Westendorf *et al.* (2000). The limited CP content of dried cafeteria left-over in the present experiment was formulated and compensated by soybean meal.

CF and EE content (1.33%) and (2.35%) respectively, of cafeteria left-over in the present study were lower than CF (3.62) and EE (13.13) reported by Temesgen and Chen *et al*. (2007). lower fat content in the present study compared to other authors report might be associated with the lower fat and oil contents of cafeteria left-over.

ME content of dried cafeteria left-over in the present study was slightly lower than reported by Temesgen and Chen *et al*., but higher than the recommended energy (3200 kcal ME/kg DM) for broilers by Scanes *et al.* (2004). The difference in nutrient composition of dried cafeteria left-over among different studies might be attributed to differences in food type, methods of food preparation, moisture contents and processing methods (Amene *et al*., 2015). Moreover, Tegene *et al*. (2009) suggested that the nutrient composition of cafeteria left-over might be affected during preparation of the food. The optimum metabolizable energy value and high CP content of dried cafeteria left-over in the present study showed that the diet can be used as a cheap energy source with small supplementation of protein in the broilers nutrition.

Nutrient Intake

The present study depicted lower nutrient intake of Ross chickens with the increasing proportion of cafeteria left-over and soy meal diet unlike Chen *et al.* (2007) who reported an increased feed intake and FCR with increasing level of dried feed west product on a uniform (mash) feed diets. Chae *et al*. (2000) and Myer *et al*. (1999) also found an increased feed intake on pigs fed with increased level of dehydrated food wastes which was associated with higher amount of crude fiber.

The lower nutrient intake of Ross chickens fed on cafeteria left-over and soy meal in the present study might be due to the difference in the feed forms which is supported by many Authors. *Zohair, et al. (*2012); Kim *et al*. (1996) and Munt *et al*. (1995) all reported that feeding on Pelleted ration improved the feed intake and feed conversion ratio of broiler chickens compared to mash diets. Similarly, Nir *et al.* (1995), Bertechini *et al.* (1992) and Moran (1990) reported that pelleted diets gave greater feed intake than did mash forms in broilers. Asha Rajini *et al*. (1998a) investigated the effect of particle size on feed intake and growth in that the increase in particle size increases feed intake and subsequently improves growth rate of birds, however, fine feed particles tend to stick to the inside of the chicken's beak, resulting in a fall in feed intake and consequently reduced growth rate. According to Behnke (1998), the reason for the enhanced performance on Pelleted ration was due to a compound effect of increased digestibility, decreased ingredient segregation, decreased feed wastage, reduction of energy during prehension and improved palatability.

The CF intake of Ross chickens in the present experiment showed linear reduction with increasing proportion of dried cafeteria left-over, which was associated with the lower crude fiber content in cafeteria left-over and lower dry matter intake of the chickens.

Body Weight Gain

In this experiment the conventional ration was in pelleted form where as the non-conventional diets were in mesh form. The increase in body weight gain, average daily gain, FER and PER of Ross chickens fed on diets with higher proportion of conventional (pelleted) ration compared to non-conventional (mash) diets was associated with the form or particle size of the diet. Consistent with the present findings, Asha Rajini *et al*. (1998a); Asha Rajini *et al*. (1998b); Mendes *et al*. (1995) and Moran (1990) reported that pelleted diets had a better feed efficiency and performance compared to mash forms. Many other Authors also reported that mash-fed birds had lower body weight than birds fed on crumble and pellet diets (Zakeri *et al*., 2013), (Preston *et al*., 2000) , (Munt *et al*., 1995) and (Kim and Chung, 1994).

The result of the present experiment on mortality was different from *Zohair, et al.* (2012) and Silva *et al*. (1988) investigation's, who found that birds receiving pelleted feed showed greater mortalities than birds receiving mash feed, which was associated with the incidence of ascites (a cardiovascular metabolic disorder characterized by fluid accumulation in the abdominal cavity). The higher mortality rate on chicks fed on mixture of non-conventional diets in a mash form in the present experiment might be due to inadequate intake of nutrients associated with susceptibility to some hygienic problems.

Carcass Trait

Chickens fed on mixture of non-conventional diets (cafeteria left-over and soy meal) showed lower value on the most economically important carcass traits compared to pellet based conventional diets. On the other hand, Chen *et al*. (2007) found no significant difference on dressing percentage, carcass weight, weights of the liver, abdominal fat, breast and thigh weights between chickens fed on concentrate mix and diets with different level of dehydrated food west product inclusion. The result on the present experiment might be associated with the poor nutrient intake of chickens fed on the mesh feed forms, which intern is affected by the particle size, digestibility, palatability and ease of prehension of the diet (Behnke, 1998; Asha Rajini *et al*., 1998a and Asha Rajini *et al*., 1998b).

Similarity on slaughter weight, eviscerated weight, thigh and drumstick, breast, back, wings and abdominal fat weights among chicks fed on pure pelleted ration and 67:33 (conventional: non-conventional) combination of diet were attributed to the higher proportion of pelleted diet in the treatment. On the other hand, TEO and TNEO were similar among chickens fed on pure conventional and mixture of conventional and non-conventional diets. Lower fat accumulation of chickens fed on high proportion of non conventional diet has implication on human health.

In general, the sole non-conventional diet (dried cafeteria left-over with soy meal) showed lower performance on economically important carcass traits, despite the lower production cost. Therefore, it can be suggested that 33% replacement of pelleted diet by dried cafeteria left over with small inclusion of soy meal was found to be economically feasible strategy in the feeding of broiler chickens, given that the form of the diets were the major source of variation.

Conclusion

The nutritional composition particularly the crude protein and metabolizable energy contents of dried cafeteria leftover at Dilla University were good compared to previous reports. Therefore, cafeteria leftover can better replace the energy source feed ingredients in broiler ration with small inclusion of protein supplements. The variation in nutrient intake and performance of Ross chickens among treatments with different proportion of conventional and non-conventional ration in the present study was probably due to the difference in the diet forms. In general, this study showed that the nutrient intake and growth performance as well as carcass parameters of Ross 308 chickens were increasing with increasing proportion of conventional pelleted ration; however, the difference in diet form (particle size) was the major source of variation among treatments.

According to the present study, it can be concluded that 33% replacement of conventional ration by non-conventional cafeteria left-over with small inclusion of soy meal was found to be economically feasible feeding strategy of broilers and cafeteria leftover found to be an alternative feed resource for poultry farming in and around towns where the resource is abundantly available. However, further investigation is required to evaluate the replacement value of cafeteria left-over for conventional concentrate ration with similar diet forms in broiler as well as layer ration.

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