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The Effect of Feeding Graded Level of Dried Cafeteria Food Leftover on Egg Production and Quality of White Leghorn Chickens

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ABSTRACT
A study was conducted to evaluate the effects of feeding graded level of dried cafeteria food leftover on egg production and quality of white leghorn chickens on feed intake, egg production and quality, feed conversion ratio, fertility and hatchability of white leghorn (WL) layer at Haramaya University Poultry Farm for 90 days. Two hundred twenty five WL layer at five months of age with average initial body weight of 1029.04± 18.7314 g (mean ± S.D) were randomly distributed to five treatments, each replicated three time with thirteenlayers and two cockerels per replicate in CRD and kept on a deep litter system. The treatment rations were formulated to contain dried cafeteria food left over in layers ration at a proportion of 0 (T1), 15 (T2), 30 (T3), 45 (T4) and 60 (T5) percent of the total ration. Daily dry matter intake of birds fed diet consisting T1 (93.1±0.16g) was significantly (P<0.05) lower than T2 (94.1 ± 0.16), T3 (94.1±0.16g), T4 (94.4±0.16g) and T5 (94.4±0.16g). The results of the experiment showed that there were no significant differences (P>0.05) among treatments in hen-day egg production (34.5, 34.6, 36.0, 36.4 and 37.2 (SEM= 0.88), for T1, T2, T3, T4, and T5, respectively. There is also no significant difference (p<0.05) among albumen weight, shell weight, yolk index, yolk ratio, yolk diameter, yolk height, albumen ratio, albumen height and Haugh unit. Roche color fan reading revealed that eggs from hens fed T1 diet has significantly (P<0.01) lower yolk color (3.724±0.2237) than T2 (5.41± 0.22), T3(5.72 ±0.22), T4 (4.99 ±0.22) and T5 (5.74 ±0.22). Birds fed control diet (T1) has lower yolk weight (13.99± 0.15) than T2 (14.67±0.157),T4 (14.68±0.15), and T5 (14.76± 0.15) respectively, but slightly higher than T3 (13.59± 0.15). Shell thickness is lower (p<0.05) for T1 (0.299 ± 0.005) and T5(0.290± 0.005) than T2 (0.325± 0.005), T3 (0.327± 0.005) and T4 (0.319± 0.005) respectively. The logistic regression results of fertility and hatchability did not show any significant (p< 0.05) difference among treatments.Increasing level of dried cafeteria food leftover inclusion in layers ration hasno negative impact on production performance, quality andconcluded that dried cafeteria food left over can be included in poultry ration up to 60%.
Key words:Dried cafeteria food leftover, Egg quality, Fertility, Hatchability

1. INTRODUCTION

In tropical Africa, the levels of livestock productivity and availability of livestock products like meat, milk and eggs for human consumption are the lowest in the world. Even at the existing low levels of consumption, production does not keep pace with demand and the region as a whole moves towards the position of a net importer of livestock products despite its apparent potential for livestock production. Based on such demands, there is a greatest increase in the production of poultry and pigs (Mengesha, 2011), out of which poultry is the one that contributes the largest parts of animal food source (Permin and Pederson, 2010). The species of chicken is the largest constituents of poultry population (Gueye, 2003) and the indigenous once are the most commonly distributed across every corner of tropical countries of Africa.

In most parts of Ethiopia, consumers have high preferences for chicken products. Besides preference, chicken products provide proteins of high biological value. Poultry production serves as a simple means of generating family income and employment opportunities. Compared to other domestic animals, poultry can be raised with relatively low capital investment and readily available household labor. Thus poultry play an important role in the diet and economy of the Ethiopian people (Solomon, 2004).One serious problem of poultry production in Ethiopia is that cereal grains are often difficult to obtain for poultry feeding as they form the stable diet of the people. As a result, the country experiences serious shortage of conventional poultry feeds. Production is quite low as the chickens are undernourished for a significant part of the year (Amha, 1990).

In commercial poultry production system, profit can be attained by minimizing feed cost which accounts for more than half of the total cost of production. According to Wilson and Beyer (2000) feed cost accounts for 60-70% of the cost for poultry production. Thus, it is necessary to look for alternative feedstuffs which are locally available, cheap and nutritionally adequate substitute for conventional feedstuffs used in poultry production. Therefore, non-conventional feeds could partly fill the gap in the feed supply, decrease competition for food between humans and animals, reduce feed cost, and contribute to self-sufficiency in nutrients from locally available feed sources. It is so, imperative to examine for cheaper non-conventional feed resources that can improve intake and digestibility of low quality forages (Tegene*et al*., 2009).

Feedstuffs such as kitchen leftovers can be used in Ethiopia, and could be invaluable feed resources for small and medium size holders of livestock. According to Tegene*et al*.(2009) food leftover (food wastes) are not fully utilized and substantial amounts of nutrients lost during preparation of food, especially from cafeterias of universities, hospitals and hotels.Currently, large amounts of food waste generated from household and industries have become one of the main factors to cause environmental pollution. To overcome this problem, the change of food leftover to useful materials is the best option. The best recycling way of food waste to minimizing the pollution it causes is converting it to animal feed(Kim *et al*., 2001). Therefore, driedfood leftover could be used as a supplemental feed or a feed ingredient for swine and poultry (Kim, 1995)not only to decrease the use of expensive feed ingredients, such as imported feeds, but also to reduce environmental pollution (Yang *et al*., 2001).

Even though study have been done on many animal feed sources in Ethiopia, there are many alternative feed resources like food leftover, which are not yet studied and exploited as animal feeds. Rather it is disposed as waste that is valueless. In Ethiopia there is expansion of higher learning institutions and hotels which gives food service for large number of people and this yield large volume of food leftover. Although some farmers/producers are using this feed resource as animal feed, it is not yet investigated to be used as livestock feed specially for poultry. This indicates the gap which needs investigation on this feed resource for effective utilization. So taking this fact into consideration, this study was conducted to evaluate the value of including student's cafeteria food leftover in poultry ration with the objectives;

- To determine the effect of feeding graded level of dried cafeteria food leftover on egg production, quality, fertility and hatchability of white leg horn chickens.

2. MATERIALS AND METHODS

2.1. Description of the Experimental Area

The experiment was conducted at Haramaya University Poultry Farm, which is located at 42^{o} 3` E longitudes, 9$^{o}$ 26`N latitude at an altitude of 1980 meter above sea level and 505 km east of Addis Ababa. The mean annual rainfall of the area amounts to 780 mm and the average minimum and maximum temperatures are 8 and 24°C, respectively (AUA, 1998).

2.2. Experimental Rations and Ingredients

The feed ingredients used in formulation of the experimental rations contain dried cafeteria food leftover (DCFL) from Haramaya University student's cafeteria, maize grain, nuogseed cake, wheat bran, soybean meal, salt, vitamin premix and limestone. Maize grain and salt were purchased from Haramaya, nougseed cake, soybean meal from Addis Ababa oil extraction plants and vitamin premix from Akaki feed processing plants.

Before formulation of the treatment diets, cafeteria food leftover was dried on plastic sheet in the sun for 2-3 days for removal of moisture and reduces molding, ground and packed well for storage. The ground dried cafeteria food leftover was properly mixed before the layers ration is formulated. Chemical analysis was done on a representative samples of feed ingredients and based on the results of the analysis five treatment rations was formulated. Ingredients such as cafeteria foodleftover, maize grain, nougseed cake, and soybean were hammer milled to pass through 5mm sieve, packed in sack and stored until required for experimental rations formulations. The five treatment rations formulated were approximately iso-caloric and iso-nitrogenous with 2700 kcal ME/kg DM and 16% CP, respectively as contained in the commercial ration to meet the nutrient requirements of layers. This formulation was based on result of pre- chemical analysis of experimental feed ingredients for energy and nitrogen.

The treatments were inclusion of graded levels of dried cafeteria food leftover in layers ration (Table 1).

Table 1.Proportion of ingredients used in formulating the experimental rations

Ingredients (%)	Treatments				
	T1	T2	T3	T4	T5
Maize	60.7	49.5	35.5	21.1	7.1
Wheat bran	8.6	2.7	2.7	2	1.2
Nougseed cake	10.2	12.7	10.7	10.8	10.5
Soyabean meal	13.2	12.8	13.8	13.8	13.9
Limestone	6	6	6	6	6
DCFL	0	15	30	45	60
Vitamin premix	0.8	0.8	0.8	0.8	0.8
Salt	0.5	0.5	0.5	0.5	0.5
Total	100	100	100	100	100

DCFL-dried cafeteria food leftover; T- treatments

2.3. Experimental Chickens and Management

Before the introduction of the experimental birds to the site, the experimental house was cleaned, washed and disinfected for sanitation. Experimental birds were vaccinated following the practice of the farm. Throughout the experimental period birds have access to clean drinking water. A total of 225 White Leg Horn Chicken (WLH) aged five monthswere taken from Haramaya University poultry farm. The weight of the chicks was determined for random distribution for each experimental diet (treatments). Then, 45 chickens were distributed per treatment of three replications (15 pen) making a total of 225 birds in a deep litter system and were fed with the respective treatment rations during the seven days of acclimatization period and throughout the experimental period of 90 days on *ad-libitum* basis.

2.4. Experimental Design and Treatments

The experimental design used was completely randomized design involving five different rations. The rations contain dried cafeteria foodleftover at the rate of 0, 15, 30, 45 and 60% in the concentrate mix and are named as T1, T2, T3, T4 and T5, respectively. Each treatment has been replicated three times with thirteen white leg horn layers and two cockerels of the same strains. The cockerels were introduced,during the lastone month of the experimental period. The layout of the experiment is given in table 2.

Table 2.Layout of the experiment

Treatments	Replication	Birds per replication
T1 0%DCFL	3	15
T2 15%DCFL	3	15
T3 30%DCFL	3	15
T4 45%DCFL	3	15
T5 60%DCFL	3	15
Total	**15**	**225**

DCFL- dried cafeteria foodleftover; T-treatments

2.5. Measurements and Observations

2.5.1. Chemical analysis

Representative samples were taken from each of the feed ingredients used in the experiment. The feed samples of the experiments were analyzed for dry matter (DM), nitrogen(N), ether extract (EE), crude fiber (CF) and ash, using the Weende or proximate analysis method of the A.O.A.C. (1990) and crude protein(CP) was determined by multiplying nitrogen by 6.25. Chemical analyses of feeds were done in nutrition laboratory of Haramaya University. Metabolisable energy (ME) of the experimental diets was determined by indirect method according to Wiseman (1987) as follows:

ME (Kcal/kg DM) = 3951 + 54.4 EE – 88.7 CF – 40.8 Ash

2.5.2. Feed intake

A weighed amount of feed was offered twice a day (0800 and 1700 hours) at the same time and orts was collected the nextmorning and weighed after removing external contaminants by visual inspection. The feed offered and refused wererecorded for each replicate and multiplied by respective DM content. The amount of feed consumed was determined as the difference between the feed offered and refused on DM basis. Samples of feed offered and refused daily per treatment was bulked across the experimental period and sub sampled at the end.

2.5.3. Egg production

Eggs were collected from each pen at 0800, 1300 and 1700 hours. The sum of the three collections along with the number of birds alive on each day was recorded and summarized at the end of the period. Rate of lay for each treatment expressed as the average percentage hen-day and hen- housed egg production were computed by taking the average values from each replicate following the method of Hunton (1995) as:

$$\text{\% Hen-day egg production} = \frac{\text{Number of eggs collected per day}}{\text{Number of hens present that day}} \times 100$$

$$\text{\% Hen-housed egg production} = \frac{\text{Sum of daily egg counts}}{\text{Number of hens originally housed}} \times 100$$

2.5.4. Egg weight and Egg mass

Eggs collected daily were weighed immediately after collection for each treatment and average egg weight was computed by dividing the total egg mass to the number of eggs.

2.5.5. Feed conversion ratio

Feed conversion ratio was determined per replicate by calculating the weight of feed consumed per egg mass. Average feed conversion ratio for each treatment was also computed as the average of the replicates for each treatment.

2.5.6. Egg quality parameters

Internal egg quality parameters were measured for each replicate. For internal quality, three eggs were randomly picked and weighed once a week from each replicate. The weighed eggs werebroken on a flat tray to measure yolk color,albumen height and yolk height. Haugh unit, yolk index, yolk ratio and albumen ratio were measured according toAltan and Akbas (1998). Height of the thick albumen of each egg was measured with the tripod micrometer and the value for each treatment was computed as Haugh unit (Dunnington, 1999).

$$\text{Haugh unit (HU)} = 100 \text{ Log } \left(H - \frac{\sqrt{G}\,(30W^{0.37} - 100)}{100} + 1.9\right)$$

Where

HU= Haugh unit (g)
H= observed albumin height (mm)
G= gravitational constant, 32.2
W= observed weight of egg

$$\text{Yolk index (\%)} = \frac{\text{Yolk height}}{\text{Yolk diameter}} \times 100$$

$$\text{Yolk ratio (\%)} = \frac{\text{Yolk weight}}{\text{Egg weight}} \times 100$$

$$\text{Albumen ratio (\%)} = \frac{\text{Albumen weight}}{\text{Egg weight}} \times 100$$

Yolk color was measured by first removing yolk membrane, mixingthe yolk thoroughlyandtaking sample droplet on pieces of white paper andcompared with Roche fan measurement strips which have 1-15 strips with color ranging from 1 rated as pale yellow and 15 as deep intense to reddish orange. Weights of shell, albumen, and yolk weretaken separately by sensitive balance. Eggshell thickness was measured on three sites on the equator, broad and narrow end of each egg using a micrometer. The average of the three measurements was taken as thickness of each egg shell. Yolk diameter wasmeasured by ruler after breaking the eggs on flat tray.

2.5.7. Fertility and hatchability of fertile eggs

The eggs for incubation were collected and stored for 5 days at temperature of 14 °C. Medium size eggs were selected by visual inspection and 15 eggs from each replicate and a total of 225 eggs were used for fertility and hatchability determination. The temperature and relative humidity of the setter and hatchery was adjusted to 37.5°C and 85-90%, respectively. The eggs were put in the setter by keeping small end down and turned tilting the trays at 45° which turns eggs in two directions with an automatic turner of the incubator at two hour intervals. Fertility was determined by candling the incubated eggs on the 9th, 14th and 18th day of incubation in the dark room. At the time of candling the infertile eggs with clear appearance of white egg and yolk and also dead embryos have been removed from the setting tray. The fertile eggs with the demarcation of dark spot and numerous blood spot extended from the dark spot of the yolk were kept till the end of hatchability in the incubator (North, 1984). Average percentage fertility for each treatment was computed by taking the average values of the replicates which arrived at by dividing the total number of eggs found fertile at candling by total number of eggs set and multiplying by 100. Finally, the average percentage of fertility of the 9th, 14th and 18thday of incubation was taken (Bonnier and Kasper, 1990).

$$\% \text{ Fertility} = \frac{\text{Total fertile eggs}}{\text{Total eggs set}} \times 100$$

Average percentage hatchability of the fertile eggs for each treatment was computed by dividing the number of chicks hatched by the number of fertile eggs set and multiplying the value by 100 according to Rashed(2004) and Fayaye*et al*. (2005) as follows.

$$\text{Hatchability as percentage of fertile eggs set} = \frac{\text{Number of chicks hatched}}{\text{Total fertile eggs}} \times 100$$

$$\text{Hatchability as percentage total egg set} = \frac{\text{Number of chicks hatched}}{\text{Total eggs set}} \times 100$$

2.5.8. Statistical Analysis

The data collected were subjected to statistical analysis using GLMprocedure of SAS (2008). When the analysis of variance indicated the existence of significant difference between treatment means, Duncan's multiple range test(DMRT) method was used to differentiate between treatments that are different from each other.

The following model was used to analyze quantitative data (Montgomery, 2001).

$Y_{ij} = \mu + T_i + e_{ij}$

Where,

Y_{ij} = represents the jth observation (experimental unit) taken under treatment i.

μ= over all mean

T_i = treatment effect

e_{ij} = random error

General logistic regression analysis was employed for data recorded on fertility, hatchability, yolk color (1/2/3/4/5/6/7/8/9/) and embryonic mortality.

Model : $\left\{ \ln\frac{\pi}{1-\pi} \right\} = \beta_0 + \beta_1 * (X)$ Where, β = slope X=treatment

π = probability, Test H_0: No treatment effect (i.e., β_1=0) vs. H_A: significant treatment effect ($\beta_1 \neq 0$)

3. RESULTS

3.1. Chemical Composition of Experimental Feeds

The chemical composition of the feed ingredients of rations is shown in Table 3 and Table 4, respectively.

Table 3.Chemical composition of feed ingredients used to formulate experimental rations on percentage DM basis

Chemical components	Ingredients DCFL	Noug seed cake	Soya bean meal	Maize grain	Wheat bran
DM	91.21	92.15	93	90	90.5
CP	9.02	29.6	39.04	8.46	16
EE	13.13	8.14	9.21	6.24	4.2
Ash	7.7	9.1	5.75	5.9	6.1
CF	3.62	18.34	5.71	2.83	12.4
Ca	0.8	0.37	0.35	0.02	0.12
P	0.72	0.32	0.83	0.82	1.21
ME (kcal/kg)	4029.48	2395.78	3710.78	3710.95	2402

DM=dry matter; CP =crude protein; EE = ether extract; CF = crude fiber; Ca = calcium; P = phosphorus; ME = metabolizable energy; kcal = kilo calorie; kg = kilogram.

Table 4.Chemical composition of treatment diets containing graded levels of dried cafeteria food leftover on percentage DM bases.

Chemical components	Treatments T1	T2	T3	T4	T5
DM	90.76	91.49	90.64	90.76	91.59
CP	16.1	16.3	16.2	16.3	16.4
EE	8.23	9.01	9.03	10.3	10.4
Ash	12.06	13.05	13.98	14.01	13.82
CF	12.8	12.9	12.3	13.0	13.1
Ca	2.0	2.4	2.3	2.2	2.1
P	0.91	0.68	0.78	0.81	0.72
ME (kcal/kg)	2771.30	2764.47	2780.83	2786.61	2790.93

DM=dry matter; CP =crude protein; EE = ether extract; CF = crude fiber; Ca = calcium; P = phosphorus; ME = metabolizable energy; kcal = kilo calorie; kg = kilogram; T1 =0%DCFL; T2 = 15% DCFL; T3 = 30%DCFL; T4 = 45%DCFL;T5 = 60%DCLF;DCFL = dried cafeteria food leftover.

3.2. Dry matter Intake

The effect of dried cafeteria food left over as inclusion in poultry ration on dry matter intake is given inTable 5. The dry matter intake of birds fed T2,T3,T4, and T5diets is similar but group fed T1 ration consumed lower($P < 0.05$)amount of dry matter compared to the other treatments.

Table 5.Feed intake and performance of white leg horn chickens fed graded levels of dried cafeteria food leftover

Parameters	Treatments						
	T1	T2	T3	T4	T5	SEM	SL
DMI (g/hen/d)	93.1[b]	94.1[a]	94.1[a]	94.4[a]	94.5[a]	0.16	*
Initial BW (g)	1087.4	1046.2	1071.1	941.1	999.3	18.73	NS
Final BW (g)	1120.1	1079.2	1104.4	978.9	1039.2	18.42	NS
HDEP (%)	34.5	34.7	36.0	36.4	37.2	0.884	NS
HHEP (%)	34.1	34.3	34.5	35.9	36.7	0.82	NS
Egg weight (g)	51.647	50.7	50.3	52.6	52.1	0.44	NS
EM (g/hen/d)	17.0	16.7	17.4	18.1	18.5	0.46	NS
FCR	1.2	1.5	1.6	1.7	1.9	0.078	NS

[a, b] means with in a row with different supper scripts are significantly different ,* = significant at (P <0.05); ** = significant at (p < 0.01); NS = non- significant (p>0.05); SL=significant level; SEM = standard error of mean; DMI= dry matter intake; EM= egg mass (g/hen/d); T1 =0%DCFL; T2 = 15% DCFL; T3 = 30%DCFL; T4 = 45%DCFL; T5 = 60%DCFL; DCFL = dried cafeteria food leftover, HDEP- hen day egg production, HHEP- hen housed egg production, FCR= feed conversion ratio

3.3. Egg Production

The effect of including graded level of dried cafeteria food leftover in layers ration on hen- day egg production is presented in Table 5. The mean percentage hen- day egg production of the birds fed the five experimental rations was not significantly ($p > 0.05$) different among the treatments.

3.4. Feed Conversion Ratio, egg weight and egg mass

The output of including DCFL at different level in layers ration on feed intake and conversion ratio and egg weight and egg mass is presented in Table 5. The feed conversion ratio did not differ significantly ($p > 0.05$) between treatments but tends to increase with inclusion level of DCFL.The effect of using dried cafeteria food leftover as inclusion in poultry ration on egg weight and egg mass shows no significant ($p > 0.05$) difference among the treatments.

3.5. Egg Quality Parameters

The mean value of shell, albumen and yolk weight and yolk index, yolk ratio and diameter are shown in Table 7. There was no significant ($p > 0.05$) differences in shell and albumen weight among the treatments. Yolk weight was significantly ($p < 0.05$) higher in rations containing DCFLthan the control.

3.6. Yolk color and albumen quality (Haugh unit)

The logistic regression results for yolk color showed significant difference (Pr> Chi Sq< 0.0001 at $\alpha = 0.05$) with Wald Chi Sq value of 63.958 among the treatments. The treatment means from SAS output for yolk color andHaugh unitare presented in Table 7. There was no significant difference ($p>0.05$) between treatments in Haugh unit.

Table 6.Egg quality parameters of white leg horn chickens fed ration containing graded levels of dried cafeteria food leftover.

	Treatments						
Parameters	T1	T2	T3	T4	T5	SEM	SL
Albumen weight(g)	28.24	27.85	27.54	28.46	27.11	0.32	NS
Yolk weight (g)	13.99[ab]	14.68[a]	13.60[b]	14.68[a]	14.76[a]	0.16	*
Shell weight (g)	4.29	4.79	4.63	4.57	4.43	0.096	NS
Yolk index (%)	46.56	45.43	46.09	45.43	48.66	0.598	NS
Yolk diameter (cm)	3.27	3.80	3.32	3.38	3.37	0.092	NS
Yolk color	3.72[b]	5.41[a]	5.72[a]	4.99[a]	5.74[a]	0.224	**
Yolk ratio (%)	26.72[c]	29.25[a]	27.23[bc]	28.82[ab]	28.00[bc]	0.3373	NS
Albumen ratio(%)	53.95	55.65	55.07	54.81	51.47	0.699	NS
Shell thickness	0.299[ab]	0.325[a]	0.327[a]	0.319[a]	0.290[b]	0.005	*
HU	92.43	87.93	88.79	87.69	88.06	0.171	NS

[a, b c] = Means with in a row with different supper scripts are significantly different; ** = significant at ($p< 0.01$); *= significant at ($p<0.05$); NS = non- significant; SL = significant level; g = gram; cm = centimeter; SEM = standard error of mean;T1 =0%DCFL; T2 = 15% DCFL; T3 = 30%DCFL; T4 = 45%DCFL;T5 = 60%DCFL; DCFL = dried cafeteria food leftover.

3.7. Fertility and Hatchability of Eggs

Mean values for the treatments are presented in Table 8. The logistic regression results for fertility and hatchability of eggs showed no significant difference (pr>chisq 0.395 and 0.407 at $\alpha = 0.05$) with Wald chi-Sq value of 4.081 and 3.993, respectively among the treatments.

4. DISCUSSION

4.1. Chemical Composition of Experimental Feeds

The DCFL analysed in this study has high metabolsable energy and contain CP valuewhich is lower than most values indicated in some studies (Sadoa, 2005), who reported 15.54% CP. The higher ether extract and metabolisable value shows that the diet can be used as energy source in the ration of layers. The CF and ash content of DCFL is comparable with the findings of Sadoa (2005) who reported 2.34% crude fiber and 5.26 ash% but has low calcium content than the value of dehydrated kitchen waste 2.82%. This result indicated that using DCFL in poultry ration needs additional calcium for maximum egg production, egg mass and feed conversion ratio (William *et al*., 2006), who reported 3.52-3.62% of Ca for maximum production. The experimental ration convinces the same percentage of protein (CP %) and energy (ME) which slightly increase with the increasing level of DCFL because of energy content of the diet

4.2. Dry matter Intake

The finding of this study is in agreement with that of Maeng*et al.* (1997), which reported that increasing substitution level of fermented food leftover up to 50% increases feed intake, and kim*et al.* (2001) also noted that increasing the swine manure and food leftover mixture in broilers diet increases the feed intake. Kuo-Lung Chen, et al. (2007) also stated that feed intake and conversion ratio increase as dehydrated food waste product inclusion increases and the increase in feed intake is due to high fiber content of the diet.

4.3. Egg Production

Even though, percentage hen- day egg production increases as the inclusion level of dried cafeteria food leftover increases. According to Maeng*et al*. (1997) the increasing substitution of fermented food leftover up to 80 % has no significant effect on egg production. But, Cho *et al.* (2004)noted that the inclusion of 10% dried leftover food tended to increase egg production with no- significant difference while using up to 20% and 30% has significant difference on egg production relative to birds of control groups.

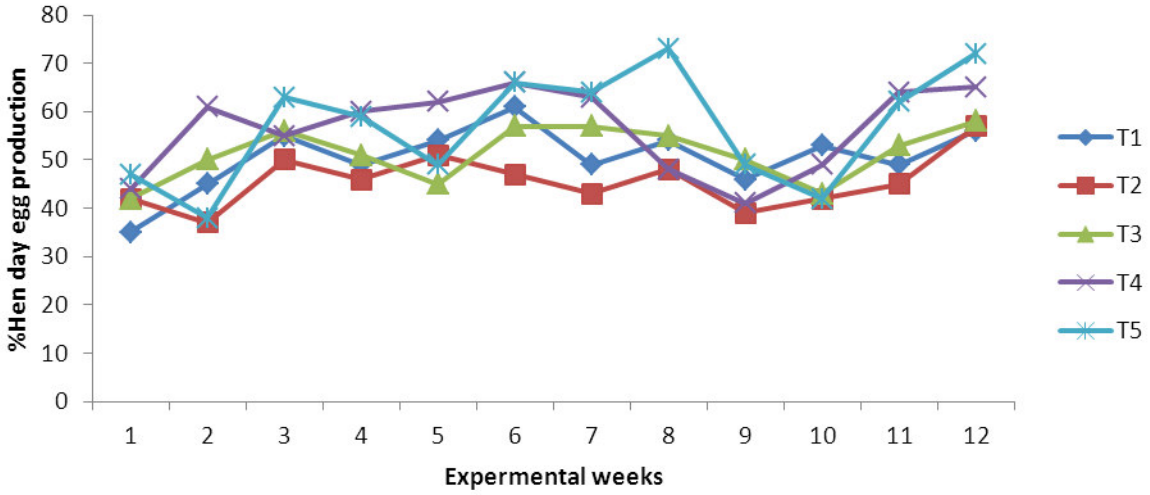

Figure 1. Weekly average hen day egg production of white leghorn chickens fed diet containing graded levels of dried cafeteria food leftover.

4.4. Feed conversion ratio, Egg weight and Egg mass

This result supported with that of Sadoa (2005) who reported no significant difference in feed conversion when layers fed with DCFL from 12.5 to 50 % in the ration. Variation in feed conversion efficiency is highly dependent on number of eggs produced (51%) followed by feed consumption (31%)and egg weight (18%) (Hirnik*et al.,* 1977).Egg production and feed consumption between treatments did not vary widely in the present study, thus significant difference in feed conversion is not expected.

However, egg mass tended to increase with increasing level of DCFL as inclusion in poultry ration the DCFL has high metabolisable energy and low crude protein ratio. This implies that using energy diet in poultry ration has no impact on egg weight and mass, which agreed, with Wu *et al*. (2005) who reported the absence of effect of dietary energy on egg production and egg mass. Harms *et al*. (2000) also noted that egg production was not affected by dietary energy. Yung-Keun Han *et al*. (2011*)* also found no significant difference on egg weight when high energy feed was fed to layers. But these results disagree with the finding of Cho *et al.* (2004) and Sadao (2005), who reported feeding dehydrated kitchen waste up to 50% significantly depressed egg weight.

4.5. Egg shell thickness

The mean egg shell thickness is given in Table 6. The result reflect that there was significant ($p< 0.05$) difference among treatments in egg shell thickness. The thickness of the shell is slightly higher for T2, T3 and T4 than T5 which agreed with that of Cho*et al.* (2004) who stated that increasing dried food leftover decreases egg shell thickness. The egg shell thickness is comparable with the findings of (Senayit, 2011) who reported 0.3mm for white leghorn chickens fed different proportion of soybean meal. Moreover, Moreki*et al*. (2011) indicated that shell weight, shell percentage and shell thickness improved significantly when dietary Ca increased from 1.5 to 2.5%. Eggshell quality and shell thickness were improved when the amount of Ca into the diet increased (Kermanshahi and Hadavi, 2006). Also Salama and EL-Sheikh (2011) reported that level of dietary calcium has significant effect on shell thickness.

4.6. Egg quality parameters

The findings of Salama and EL-Sheikh (2011) showed that albumen weight, shell weight and shell thickness is not affected by CP levels but yolk weight is significantly influenced. They also found that dietary Ca levels were not significantly affected albumin weight, yolk weight and shell weight. El-Gamry*et al.,* (2011**)** reported that most egg quality were not significantly influenced by dietary calcium level (2.4 up to 3.3%) in *Fayomi*laying hens. According to Novak *et al.* (2004) decreasing amino acid intake significantly decreased albumen weight. The yolk index values of the eggs from various treatment groups ranged from 45.43- 48.66 which is within the accepted index value of 33- 50 for yolks from fresh eggs (Ihekoronye and Noddy, 1985).Yolk index determines the freshness of an egg and large index makes for good hatchability as the eggs tend to store longer without spoilage (Odukwe, 2010).

4.7. Yolk color and albumen quality (Haugh unit)

Sadao(2005) noted that the lightness of eggshell color was significantly higher and the reverse was true for the redness of egg shell color. Roche color fan values are higher in treatments consisting DCFL. The Roche color fan reading recorded during the experiment ranges from 1(pale yellow) to 10, with majority of the egg having 3 to 8 values on the yolk color point. The Roche color fan number 7 to 8 (deeper yolk color) is accepted by consumer in most areas (Leeson and Summers, 1997). The value of these findings has Roche color fan number of accepted value in large numbers in treatments containing 15%, 30% and 60% (T2, T3, and T5) respectively. This indicates that the inclusion of graded level of DCFL slightly improved egg yolk color because the food is composed of different ingredients which might be induced yolk color.According to Williams (1992) albumen quality is not greatly influenced by bird nutrition and the decline in Hauhg units is mostly related to age of the hen and egg storage conditions. According to Ihekoronye and Ngoddy (1985) high quality egg generally have haugh unit of 70 and above. The value obtained for Haugh unit in this study was within the acceptable range, and there is no difference between the treatments.

4.8. Fertility and Hatchability of Eggs

Gabreil*et al.* (2006) reported that level of dietary protein significantly affected egg fertility and hatchability. Hocking *et al.* (2002) also reported that poor hatching results occur when nutritionally deficient feeds are used for layers. This implies that increased level of dried cafeteria food leftover up to 60% has no influence on fertility and hatchability performance of layers chickens.

5. SUMMARY AND CONCLUSIONS

A feeding trial was conducted to evaluate the effect of inclusion of graded level of dried cafeteria food leftover on egg production and quality (fertility, hatchability,feed intake (FI) and feed conversion ratio (FCR) of white leghorn layers. For the study one hundred ninety five pullets and thirty cocks of WLHchickens aged five months and fed previously on standard poultry diets were used for the feeding trial on deep litter housing system.

The experiment was conducted at Haramaya University poultry farm for 90 days following 7 days of acclimatizing to experimental diets and house. Birds were randomly distributed in to five dietary treatments that were replicated three times each containing thirteen hens and two cocks per pen. The treatments are inclusion of graded level of dried cafeteria food leftover (DCFL) in poultry ration at a percentage of 15% (T2), 30% (T3), 45% (T4), and 60% (T5) in layers ration. The five treatment rations were formulated approximately to meet the nutrient requirements of layers 2700 Kcal ME/Kg DM and 16% CP. A measured amount of feed was offered to the birds and refusals were collected every morning and weighed. Birds were measured at the beginning and at the end of the experiment.

Dry matter intake of birds fed diet consisting T2(94.07 ±0.164g*)* and T3(94.11±0.164g) was significantly ($P<0.05$) lower than T4(94.43 ± 0.164g) and T5(94.46±0.164) and T1 (93.1±0.164g) lower than all. Mean daily body weight gain of hen fed T4 (0.42±0.011g) and T5 (0.44 ± 0.011g) was significantly ($P<0.05$) higher than T2(0.36±0.011), T3 (0.37±0.011g) and T1 (0.36±0.011). The statistical analysis showed no significant difference ($p>0.05$) among treatments in hen-day egg production (34.54, 34.57, 36.01, 36.36 and 37.20(SEM= 0.884), egg mass (17.02*,* 16.68, 17.38, 18.13 and 18.48 (SEM= 0.458), for T1, T2, T3, T4, and T5, respectively. There is no significant difference ($p<0.05$) between albumen weight, shell weight,yolk index, yolk ratio, yolk diameter, yolk height, albumen ratio, albumen height, sample egg weight and Haugh unit. Roche color reading revealed that eggs from hens fed T1 diet has significantly ($P<0.01$) lower yolk color (3.72±0.224) than T2 (5.41± 0.224), T3(5.72±0.224), T4 (4.99±0.224) and T5 (5.74±0.224). Birds fed the control diet (T1) has similar yolk weight (13.99±0.157) with other treatments, but T2 (14.68±0.157), T4 (14.68±0.157 and T5 (14.76± 0.157), has higher yolk weight than T3 (13.6±0.157). Shell thickness is lower ($p<0.05$) for T1 (0.299 ± 0.005) and T5 (0.290± 0.005) than T2 (0.325± 0.005), T3 (0.327± 0.0051) andT4 (0.319± 0.005) respectively. The logistic regression results of fertility and hatchabilitydid not show any significant ($p< 0.05$) difference among treatments.

In general the results revealed that inclusion of dried cafeteria food leftover can be included up to 60% without adversely affecting egg laying performance and quality.

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