EFFECTS OF DIFFERENT LEVELS OF PROTEIN ON BODY WEIGHT AND CARCASS CHARACTERISTICS OF INDIGENOUS CHICKEN, WORABE TOWN, SILTE ZONE,ETHIOPIA

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ABSTRACT

The study was conducted between Oct2009 to Nov2010, to know the"Effects of Different Levels of Protein on Body Weight and Carcass Characteristics of Indigenous Chicken". The different levels of protein, 7.93 (T_1), 16.8% (T_2) and 19.05% CP (T_3) were studied to assess its effects on the dry matter intake, growth performance and body weight gain as well as carcass characteristics. The cost-benefit analysis for finishing indigenous male chicken on diets containing different level of protein was also undertaken. The total of seventy two indigenous male chickens with an average body weight of 1397.93 ± 2.5 g were used for the feeding trial. The experiment was designed in CRD with three dietary treatments each with three replications.The results of the experiment showed that the mean dry matter intake, cost of feed per kg, live weight gain and mean weights carcass of parts did vary ($P < 0.05$) among the different levels and maize grain only dietary treatments.T_3 (the highest CP% level) by partial budget analysis method appear to be cheaper ration which cauld be used in indigenous male chicken finishing.

Key words: *Carcass, Indigenous Chicken, Nutrition, Protein Level, Weight*

No: of Tables : 4 **No: of Figures :2** **No: of References: 19**

Introduction

Ethiopia has 38.1 million chicken populations, excluding the birds found in pastoral and agropastoral areas of the country (1) and chicken play a significant role in human nutrition and as a source of household income. Estimates based on human and livestock populations in Ethiopia showed that indigenous chickens provided 12kg of poultry meat as compared to only 5.3kg beef (2) indicating that indigenous chicken products are often the only source of animal protein for resource poor households. Thus, improving poultry productivity means increased protein nutrition and income levels of the population. Increased population growth, urbanization and rising income in many parts of the developing world is believed to result in a growing demand for food of animal origin. Poultry products are also expected to play pivotal role in this line (3).

According to (4), the productivity of indigenous poultry has always remained poor due to numerous constraints. These include extremely high mortality due to diseases and predation, poor feeding, poor housing and marketing constraints, which is mainly attributed to lack of improved poultry breeds, the incidence of chicken diseases, poor feeding and management factors (5). According to (6), local males may reach 1.5kg live weight at 6 months of age and females about 30% less. The carcass weight of local stocks at 6 month of age was 550 gram, which was significantly lower than that of Whit leghorn (875gm). However, local stock has a higher dressing percentage (5). (7) showed that there was no difference between White leghorn and local chickens raised under scavenging condition in mean daily body weight gain at 2 months.

According to (8), local chickens are sold from 6-8 months of age for meat purpose when they weigh around 700-1400g. The average age at start of lay was 195 ±28 days, with a range of 183-245 days. Mean body weight at the start of lay was 1035 ±34g ranging from 985 to 1113g. Body weights of 1.2kg and 800g are obtained at 32 weeks for normal size and dwarf breeds of local chicken in free-range system. Scavenging poultry production can be economically efficient with small management changes, for example regular watering, night enclosures, discouraging them from getting broody, and vaccination for common diseases and small energy and protein supplements, which can bring significant improvements in the productivity of local birds (8). However, most studies in chicken production in Ethiopia are concentrated on exotic birds.

In Worabe town and the surrounding periurban area, population growth, urbanization and rising income is the recent feature; as a result market demand for egg and meat is high. Realizing this fact, the administration is encouraging the development of urban and periurban poultry production with improved

management and awareness, such as through consulting and giving training service for micro and small enterprises. Recently, relatively large private enterprises and family poultry producer owned are flourishing and the major institutions for prevention and control of disease exists. With increased market demand for poultry egg and meat in urban areas, micro and small scale pity traders are also largely engaged in chicken trading. In this practice, the trade follows that mature or growing chickens, mainly males are collected from the rural areas during the few weeks preceding holydays, and sold to consumers during the days before festive days.

The practice of such trade is to take advantages of the high price for chicken during this period. However, since the system has not been supported by appropriate management, particularly feeding practices, animals are emaciated during the holding days prior to sale and consumers are forced to buy animals with poor condition at high cost. Through establishment of micro and small enterprises that engage in such trade, this scenario could be improved by introducing appropriate technology. If the practice is supported by research-based knowledge, it could link the rural poultry production with the urban, peri-urban and micro-finance based poultry enterprises, contributing a lot to the development of the countries poultry production system. So far, however, there is little or no work that attempted to improve such practice of poultry marketing. Thus, this research idea was initiated to evaluate the body weight gain and carcass characteristics of the indigenous male chicken fed with concentrate diet containing different protein levels.

2. Materials and Methods

2.1. Description of the study area

The study was conducted in Worabe town and the surrounding rural kebeles of Silte Zone. The Zone has a total area of 3047.83 km^2. Its geographical location is between 7°43' to 8°10' N latitude and 37°86' to 38°86' E longitude. Out of the total land size, 3.42% is lowland, 73.5% mid altitude and 23.01% highland. The annual mean temperature was between 10.1 to 22.5^{0}Cand the annual rainfall ranges between 650-1818 mm. The altitude ranges from 1501 to 2500 m.a.s.l. The land utilization is 65.84% cultivated land, 8.78% grazing land, 4.27% forest bushes and shrub land is 3.97% and 17.14% is covered by others. Livestock population was estimated to be 525,178 cattle, 354,671 sheep, 203,422 goats, 147,557 equines, 52,441 bee colonies, and 483,864 poultry. The Zone has 789,187 human population and has high potential for poultry production [9].

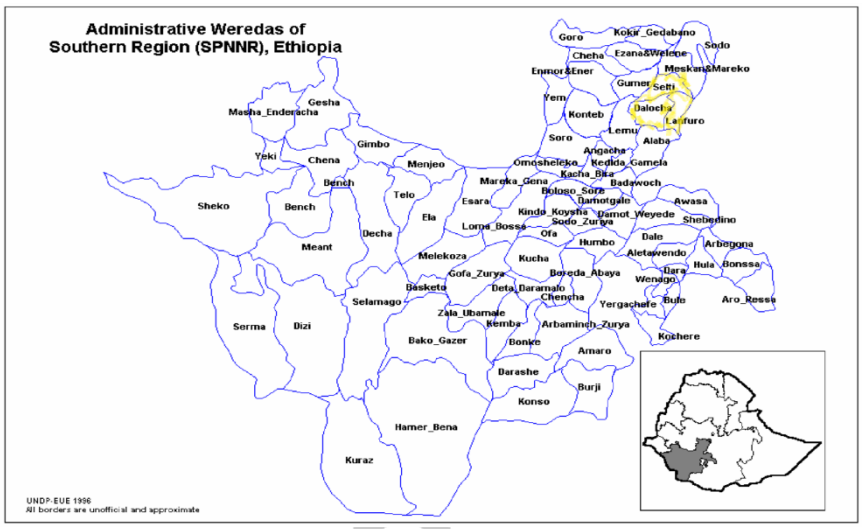

Fig 1. Map of the study area

The experiment was conducted at pick market time for chicken near the Ethiopian Christmas. The experiment was designed in CRD with two energy levels and control diet treatments each with three replications. A total of 72 birds were used for the experiment each replicate having 8 birds and 24 birds per treatment. The feed ingredients, which were used in the formulation of the different experimental ration of the study were mixture of Tikur Kocho (false banana), Noug seed (*Guizotia abyssinica*) cake (mechanically extracted), cracked maize (white dent, *Zeamays*), Meat and bone meal, Lime stone, Vitamin premix and Salt. The experimental treatments rations which were used in the study were formulated in such a way to consist different level of protein 16.78% CP and 19.05% CP. The control treatment (7.93% CP) was maize grain feeding that simulated the existing collect-hold-sale system of indigenous male chicken during festival periods.

2.1. Experimental birds management

Indigenous male chicken were purchased at farmers' door. Weight was taken during purchasing and age was estimated based on the information obtained from owners (the age was 44 ± 0.05 weeks). After the required birds were bought and brought to the experiment place, they were kept for 8 days (fed with experimental diet to get them adapted to the feeds prior to the beginning of the experiment.) before distributed to the individuals' pens and vaccinated against Newcastle disease. Following vaccination, birds were weighed, identified with leg banned and

randomly distributed to pen to which the three diets were again assigned randomly.

Floor type house which was covered with saw dust was used. The floor were properly cleaned and disinfected and divided into nine sections (pens) with local kirchat (bamboo made mat) and plastic sheet. Each pen has a size of 1.5*1.5m. A plastic made material was used to offer water and feed. Water and feed were given *adlibitum*. The experimental period consisted 45 days. Feed and water were provided once a day at 7:30am and feed refusals were collected, weighed and recorded every other day at 7:00am.

2.2. Evaluation Parameters

Body weight gain, cost of feed per unit body weight gain, rate of mortality and carcass characteristics interms of dressing percentage, carcass weight, slaughter weight, breast weight, back weight, drumstick and thigh weight, spleen weight, kidney weight, heart weight, head weight, GIT weight, small intestine weight, gizzard, and reproductive organ weight were used to evaluate the effect of the treatments.

2.3. Body weight gain

Body weight gain was taken every week individually by a sensitive balance and the average body weight per pen was taken.

2.4. Chemical analysis

The Crude Fiber (CF), Total Ash (TA) and Ether Extract (EE) contents was determined according to (9). The Nitrogen (N) content of the feed was determined by Kjeldahl procedure and crude protein (CP) was estimated by multiplying N x 6.25. The Dry matter content of the feeds was estimated by drying the feed overnight at 105^0. The Calcium was determined by atomic absorption spectrometer at the National Veterinary Institute (NVI), Debre Zeit, Ethiopia. The Metabolizabe Energy values (ME) were calculated indirectly from the Ether Extract (EE), Crude Fiber (CF) and Ash adopting the equation proposed by (10) as follow:

ME (kcal/ kg DM) =3951+54.4 EE - 88.7 CF - 40.80 Ash

2.5. Feed intake

The feed were weighed every day and offered to the respective groups and ort was collected the next morning. The mean daily intake was determined by subtracting the amount of ort that was collected from the amount of feed offered. The ort was weighed after removal of the external contaminants.

2.6. Feed conversion ratio

The Feed conversion ratio was calculated by dividing the mean daily intake to the mean daily body weight gain (11).

2.7. Carcass characteristics

At the end of the feeding trial four randomly selected chickens from each pen were starved for 12 hours and weighed immediately before slaughter. Slaughtering was done by cervical dislocation followed by cutting the head. Manual de-feathering was done after scalding in hot water. This was followed by evisceration. The respective dressed carcass of birds was packed in plastic and weighed after complete bleeding, removal of feather, shank and lungs. Then dressing percentage was determined as the proportion of the hot carcass weight to slaughter weight multiplied by 100 (12).

2.8. Partial budget consideration

The economic benefit was estimated by considering the partial budget analysis assumption. The partial budget was analyzed taking into consideration the whole feed expense and prices of bird according to the costs and benefits of a small change in the finishing practice of feeding (13), whereby other costs were assumed to be similar for all the treatments. Since, there is no any standard price regulation of chickens sold in our country, the price of chicken vary from place to place. The prices of birds at Worabe town at the end of the experiment were used. The net profit from chicken was calculated based on chick purchase price and the cost of feed that each bird consumed and the average selling prices of birds which were obtained by using the average live birds' sale.

2.9. Statistical Analysis

All the survey data were subjected to statistical analyses using (14), statistical software. Descriptive statistics was used to present the survey data. The data for the experimental part were analyzed by employing the principles of completely randomized designs following the procedures suggested by (15), using general linear model (GLM) procedures analysis of variance (16). When the analysis of variance indicated the existence of significant difference among treatment means, the Duncan's Multiple Range Test (DMRT) were employed to test and locate the treatment means, which are significantly different from the rest.

3. Results

3.1. Chemical composition of the treatment diets

As shown in table 1, the CP and energy content of the formulated feeds were 16.78% and 3386.2 Kcal/kg DM and 19.05% and 3449.4 Kcal/kg DM for T_2 and T_3, respectively.

Table 1. The chemical composition of treatment diets

Treatment ration	DM	Ash	CF	EE	NFE	ME/Kcal/kg
T_1	89.02	1.52	2.87	5.80	70.9	3949.4
T_2	87.02	7.24	7.57	7.39	48.22	3386.2
T_3	87.53	7.84	5.60	5.79	49.25	3449.4

3.2. Feed intake

Average daily dry matter intake from the start of the experiment (44 weeks of age cockerels) to (50 weeks) was significantly higher ($P<0.05$) in T_1 compared toT_2 and T_3. There was no difference between the T_2 and T_3 diets.

3.3. Body weight gain

The mean daily weight gain of chicken are shown in table 39 and figure 3. Statistical analysis has showed the existence of significant differences ($P<0.05$) among the treatment means. Accordingly, treatment consumed ration high in CP (19%) content gained more, compared to T_1 (7.9%) and T_2 (16.78%). However, all the treatments gained weight showing that at least maize grain feeding can maintain the body weight of cockerels during holding. The high dry matter intake in T_1 could be related the low CP content of the feed, as a result of which the birds consume more in an attempt to fulfill protein requirement

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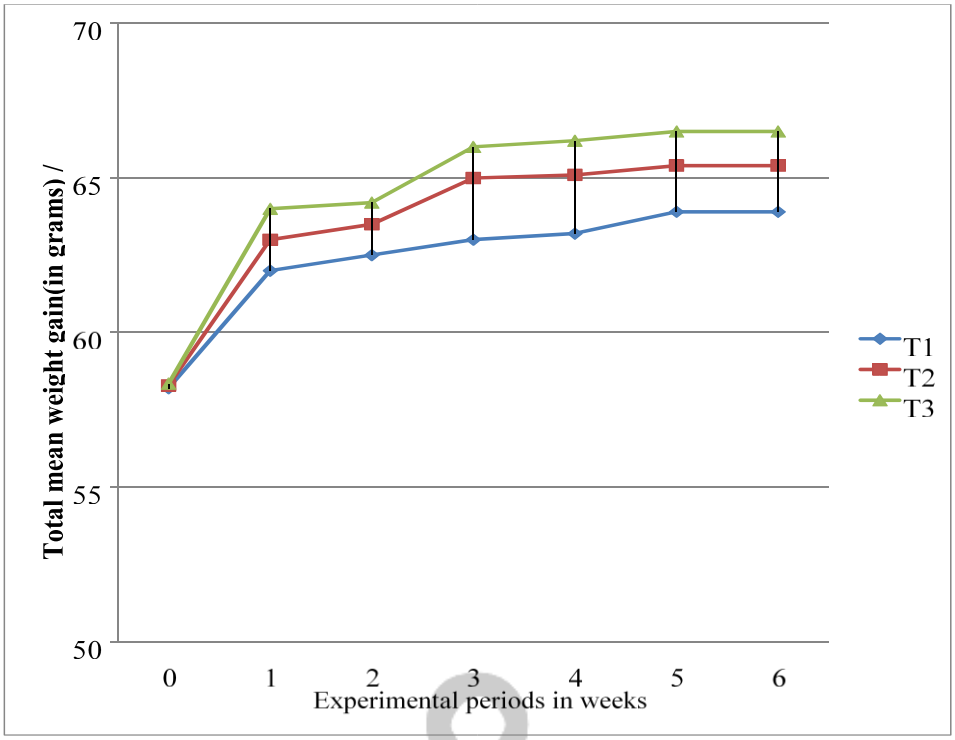

Fig 2. Mean weekly total BWt gain of indigenous male chicken during the feeding period (6 wks)

Table 2. Means of indigenous male chicken's dry matter intake, weight gain and dry matter conversion ratio (mean results of 6 weeks in gm)

Treatments	Dry matter intake (g/chick)		Body weights (g/chick)		Weight gain (g/chick)		DMCR (g DMI/g BWG)
	Total	Daily	Initial	Final	Total	Daily	
T 1	3878	86.18^{a}	1394.3	1494.5^{c}	101.46^{c}	2.25^{c}	0.03^{c}
T 2	3715	82.57^{b}	1399.1	1538.6^{b}	148.54^{b}	3.30^{b}	0.04^{b}
T 3	3765	83.68^{b}	1400.4	1584.48^{a}	200^{a}	4.44^{a}	0.05^{a}

Means with different superscripts in a column differed significantly at ($P < 0.05$); DMCR = Dry Matter Conversion Ratio; BWG = Body Weight Gain

3.3. Feed conversion ratio

The mean feed conversion ratio expressed as grams of feed intake per unit of weight gained showed significant difference (P<0.05) among the treatments and T_3 is efficient in converting the feed consumed to meat as compared to T_2 and T_1, T_2 being the intermediate.

3.4. Carcass characteristics of indigenous male chicken in the three rations

Means of carcass weight, carcass cut and organs were not of significantly different between T_2 and T_3 (P > 0.05), while means of both treatments were higher than T_1 except dressing percentage (Table 40). A report by (6) indicated that the local chickens may reach 1.5kg live weight at 24 weeks of age but this weight was reached at 50 weeks age (the birds were hold and fed only for 6 weeks) in the present study, which might be due to pre-experiment management where the chicks were grown under scavenging feed.

Table 3. Carcass characteristics of indigenous male chicken fed three different rations

	Treatment (Mean)		
Parameters	T_1	T_2	T_3
Slaughter weight	1419.93^{b}	1428.47^{a}	1440.50^{a}
Carcass weight	948.91^{b}	952.75^{a}	953.23^{a}
Dressing percentage	68.82^{b}	66.69^{a}	66.17^{a}
Breast weight	268.08^{b}	274.50^{a}	275.33^{a}
Back weight	108.08^{b}	112.16^{a}	113.33^{a}
Thigh stick weight	316.00^{b}	322.83^{a}	323.50^{a}
Spleen weight	1.83^{b}	2.16^{a}	2.30^{a}
Kidney weight	5.60^{b}	6.10^{a}	6.03^{a}
Heart weight	8.16^{b}	8.88^{a}	9.03^{a}
Head weight	55.83^{b}	60.00^{a}	59.33^{a}
GIT	108.83^{b}	111.58^{a}	114.58^{a}
Small intestine	35.91^{b}	39.83^{a}	40.16^{a}
Gizzard	35.83^{b}	38.00^{a}	38.33^{a}
Liver weight	31.50^{b}	34.33^{a}	34.33^{a}
Reproductive organ	13.90^{b}	14.66^{a}	15.33^{a}

Means with the same superscripts in rows are not significantly different from each other (P > 0.05).

4. Discussion

(17), has also reported carcass weights of 0.56 and 0.87kg for local birds and

Leghorn breed, respectively at 24 weeks of age in Southern Ethiopia when they were fed under intensive system. (18) also reported that the local birds attained 71.5% of the body weight of WLH at 6 months of age. The carcass weight of the local and WLH chickens at the age of 6 months was 559g and 875g, respectively (17). Sell price of male chicks is mainly affected by weight. However, breeds color and holidays have effect on profit. In the present study gains recorded in the indigenous male are small, which is expected, because mature birds were used for the experiment. But, the present study showed that the proper feeding during collect-hold-sale period maintain body weight and attractive live bird or carcass can be produced and sold to the consumers. However, further research work is needed to design appropriate management practices to link the existing practice with market through micro enterprises.

4.1. Mortality

As shown in Appendix table 23, the mean chick mortality observed were $T_{1=2}$, $T_{2=1}$ and $T_{3=0}$. The cause of the death was investigated by veterinarian of Silte Zone Agriculture rural development department and the result showed an noticeable toxicity but the source and type of the toxicity were difficult to identify owing to scarcity of services and due to the short duration of the research.

4.2. Partial budget consideration

Partial budget was analyzed to evaluate the profitability the three diets and employed calculating the costs and benefits of a small change in the finishing practice of feeding (13). The method employed tabulating net return (*NR*); *i.e.* the amount of money left when total variable costs (*TVC*) are subtracted from the gross returns (*GR*):*NR* = *GR-TVC*. Total variable costs include. The costs of all inputs that change due to the change in finishing practice the criterion in deciding whether or not to adopt a new finishing practice is the change in net return (ΔNR). This is the difference between the change in gross return (ΔGR) and the change in total variable costs (ΔTVC) $\Delta NR = \Delta GR - \Delta TVC$.

The marginal rate of return (*MRR*) measures theincrease in net income (ΔNR) associated with eachadditional unit of expenditure (ΔTVC): $MRR = \Delta NR/\Delta TVC$. The *MRR* measures the effect of additional cost in finishing practice on additional net returns (18). In order to perform the partial budget analysis, the variable costs and benefits were done as follows:1). Indigenous male chicken on all diet have similar labor, veterinary, purchase, transport, rent and water costs; 2). The cost for 100kg feed for T1=370, T2=280 and T3=290 birr respective 3). During the study time at Worabe town price of live indigenous male chicken was 20-45 birr (Table 41). As shown in the table 41 formulating feed diet with low and

medium returned a higher profit margin than the control (T1). This result suggests that the formulations of rations are potentially more profitable than the control in scale economy.

Table 4. Partial budget analysis for different three feeds

Variables	T_1(Control)	T_2	T_3
Gross return (GR)	1068.29 birr	1127 birr	1225 birr
Feed cost(FC)	370 birr	280 birr	290 birr
Noug seed cake	-	90.10 birr	90.10 birr
Maize	370 birr	98 birr	115 birr
Tikur kocho	-	53.90 birr	46.20 birr
Meat and bone meal	-	29 birr	29 birr
Vitamin premix	-	8.40 birr	8.40 birr
Lime stone	-	0 birr	0 birr
Salt	-	1.50 birr	1.50 birr
Bird cost	480 birr	480 birr	480 birr
TVC	850 birr	760 birr	770 birr
NR	218.29 birr	367 birr	457 birr
NRO/T_1	-	148.71 birr	238.71 birr
MRR	-	1.65 birr	2.98 birr

MRR=Marginal rate return GR= Gross returns; FC= Feed costs;TVC=Total variable costs;NR=Net return;NRO=Net return overcontrol

5. Conclusion

Among the dietary treatments (7.9, 16.78 and 19.05% protein, representing T_1, T_2 and T_3, respectively), birds fed diet of T_3 attained quantitatively the highest gain and partial budget analysis method showed its superiority. Selection of finishing birds based on consumer's preference, Providing finishing ration before selling and sell during festival days. Incorporation of "tukur kocho" as source of energy supplement in the diets of indigenous male chickens for finishing may play substantial role infavor of grain deficient country like Ethiopia. Incorporated "tukur kocho" as energy supplement ingredient of poultry is practical diet that enable developing low cost diet and benefit smallholder poultry producers at least in the 'enset' producing areas. Moreover, in order to strengthen the outcome of the present findings further work may be warranted to substantiate the results. Therefore, further research should be conducted to investigate the nutritive value and inclusion level of different protein supplements.

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Bibilography

He, Ibrahim obtained Bachlor of Science in Animal Production in 2009, at Haramaya University, Ethiopia. He was employed at Jigjiga University of Ethiopian Somali Regional State for a year through MoE, Ethiopia. He also holds Master's Degree in Range Ecology and Management from Haramaya University in 2018. He is a full member of the Ethiopian Institute of Animal welfare club in 1997 and Ethiopian Weed Science Society in 2014. He has three (3) published articles in reputable international journals across the world.

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