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On-Farm Evaluation of Cassava Root Chips and *Moringa oleifera* Leaf Meal Supplementation on the Performances of Scavenging Chicken

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Abstract

An on-farm feed supplementation trial regarding to supplement village chicken scavenging system was carried out. The aim was to evaluate the effect of cassava root chips and *Moringa oleifera* leaf meal supplementation on the growth and laying performance of White feather chicken strain kept under village scavenging conditions. Data on feed consumption, egg production and body weight (BW) change was recorded and calculated. The feed consumption was calculated as how much feed was delivered to the respective household (replicate farmer) for the entire experimental period. Egg was collected daily by the farmer and egg weight was weighed every two weeks. Initial and final BW was taken at the start and end of the experiment, respectively and the change was calculated. The results revealed that as there was no significant (P>0.05) differences regarding the whole parameters taken between the supplemented and un-supplemented groups except high feed consumption to that of the supplemented one. In conclusion, the present result showed as there was not needed to supplement the birds additional by that flock size, the resource seems sufficient enough to support the nutrient requirements of the birds and the trial was conducted at harvest time. Further investigation is warranted to test the supplementation of scavenging birds with the flock size and seasonal variation.

Keywords: Cassava root chips; *Moringa oleifera* leaf meal; On-farm; Scavenging chickens; Supplementation

Introduction

Farmers traditionally rear poultry as scavengers, without any additional investment for feeding, health care and housing, over the cost of the foundation flock. However, in most areas of the country the available scavenging feed resource is not enough to support the birds' biological and physiological requirements. Most of the efforts that have been undertaken to improve the performance of scavenging chickens have been through the introduction of exotic breeds through cross breeding and/or upgrading programmes. Very little attention has been given to other factors, such as improved feeding, housing and health care even though under scavenging systems these non-genetic factors, in particular poor nutrition and health have much greater effects on production parameters than the genetic characteristics of the birds.

In spite of the social and economic importance of the free-range system, a few works have been done on maize (*Zea mays*) and noug (*Guizotia abyssinica*) cake supplementation on egg production performance of local birds under scavenging conditions in the Central Highlands of Ethiopia [1]. The authors came to the conclusion that supplementing with a mixture of maize and noug cake resulted in an increase egg production, which in turn improved the cash income and nutritional status of the participated farmers. Gadama et al. [2] also tested the effects of soybean and maize bran supplementation on production, fertility and carcass yield of local chickens under scavenging condition in Malawi and derived in to the conclusion that supplementing local chicken with simple ration (protein and energy) significantly improved the egg production and carcass yield.

In recent years, there has been a renewed interest in rural poultry production and in the potential of rural poultry as efficient converters of locally available scavengeable feed resource base (SFRB) into eggs and meat [3,4]. However, the amounts and availability of SFRB are not constant throughout the year [5]. Such feed resources tend to vary with factors such as seasonal conditions, farming activities, life cycle of insects and other invertebrates [6]. Independently, cassava (*Manihot esculenta* Crantz) is a perennial woody herb received particular attention for its high fresh tuber yield, above 30 t/ha and can grow on poor soils, is easily propagated, requires little cultivation, and can tolerate periodic and extended periods of drought [7]. The predominantly starchy tuberous roots of cassava are a valuable source of calories [8]. However, limitations to its use in animal feed, among others, include its relatively low quantity and quality of protein [9]. On the other hand, *Moringa oleifera* leaf is the one which is rich in nutritional profile reported for some of the nutritional deficiencies of cassava could also be alleviated with *Moringa oleifera* (*Moringa oleifera* Lam.) leaf meal (MOLM) inclusion, thereby enhancing the utilization of cassava and its easy adoption by poultry farmers [10]. Moringa tree is a plant that is native to the Indian subcontinent and has become adopted in the tropical and subtropical areas around the world. The plant has probably been one of the most underused regardless of its nutritional value. The leaf meal is high in protein, with a rich amino acid profile, fatty acids, minerals, and vitamins, and low in anti-nutritional factors that can thus play a great role in poultry nutrition [10,11]. The scarcity of information on the utilization of cassava root chips (CRC) in combination with MOLM in the scavenging system prompted the current study with the following objective:

To evaluate the effect of cassava root chips and *Moringa oleifera* leaf meal supplementation on the growth and laying performance of *Whitefeather* chicken strain kept under village scavenging conditions.

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Materials and Methods

Location of the study

The experiment was conducted at Menjar area, located 120 km southeast of Addis Ababa, at an altitude of 1700 m.a.s.l. and at an altitude of 39°15" and 45'8°N latitude and 45°E longitude, Amahara regional state. The annual rainfall ranges from 637-1520 mm and the mean is 940 mm. The area has a bimodal rainfall pattern with a long rainy season from June to August and a short rainy season from March to May.

Farmers selection

At the beginning of the trial very key questions were put to select interested model farmers. The questions were: Does the household keep chicken at present and is there an interest in expanding? Who is responsible for managing the chicken? Does the poultry farming demand cause additional work load and, if so who bears the load? Can technical information be delivered directly to the family member who looks after the chicken? Would the people who look after the birds benefit directly from an increase in production? Are you interested to accept new technologies that help improve poultry production?

Formation of farmer's group

For the on-farm trial twelve farmers who have experiences in poultry keeping and willing to take part in the trial were selected, all of them that had an experiences in poultry keeping and willing to take part in the trial. Selection of these farmers was done with the help of district livestock and fisheries development agents.

Training of farmers

Both the husband and wife or other two responsible persons in each household, two extension agents in a district, poultry health, production and gender experts from the regional livestock and fisheries office participated in the training program which was held at Menjar, Arerti. The training period lasted for three days, and the objective is to change the farmers' perception and attitude towards village poultry keeping and to train them in aspects of management such as feeding, health care, house construction and husbandry practices. During the training farmers were encouraged to raise and discuss unclear issues. At the end of the training session an agreement was signed with the trained farmers concerning the execution of on-farm trials. The signed document stated that farmers should keep the birds till the end of the trial, feed the birds according to the given treatment diets and recording data.

House construction

Farmers were advised to construct a house not less than 3 m x 2 m. The density of 7 laying birds per meter square was applied during the construction of the house. Therefore all participating households constructed a poultry house from locally available materials. Nests made out of mud; was placed alongside the inside wall of the house. Each house was provided with a drinker and feeder prepared from used oil cans or stone. Natural lighting was used throughout the study period.

Feed ingredients and experimental ration preparation

The feed ingredients used to formulate supplementary ration were CRC, MOLM and salt. The ingredients were purchased from their source and nearby market. Cassava tuber purchased from Gofa-Sawella district, southern part of Ethiopia, was washed, cleaned and sifted, peeled and knife chopped into small manageable slices and then spread on a concrete level floor under direct sunlight at temperature of around 32°C to dry within 5 days and when moisture level reached around 10%. The slices turned regularly to prevent uneven drying and possible decay. The dried cassava slices then hammer milled to 5 mm sieve size. *Moringa oleifera* leaf harvested from Debre Zeit Agricultural Research Center (DZARC), Poultry Farm, at the age of around 5 years. The cut branches spread out on a polyethylene sheet and allowed to dry for a period of about 3-4 days until to get a moisture level around 12% under shade and aerated conditions. The leaves separated from the twigs before milling in a hammer mill to produce the leaf meal. Chemical compositions of the feed ingredients were determined from representative samples of CRC and MOLM for the purpose of supplemental ration formulation. The sub-standard supplemental feeds were then formulated from CRC and MOLM in the ratio of 2:1 and 0.3% salt added that used for the experiment.

Experimental birds and management

Before starting the actual experiment treatment house, watering and feeding troughs were properly cleaned. According to the experimental plan, a total of 96 average sized birds of *Whitefeather* (dual purpose) chickens strain of about 6 months of age were taken from DZARC. Each farmer was provided with 7 hens and 1 cock. The birds were vaccinated already against Newcastle disease at the station. Moreover, other health precautions and sanitary measures are taken throughout the study period. Birds kept indoors from 6 in the afternoon till 12 hours in the next morning and then were let to scavenge in all the treatments.

Experimental design and treatments

Birds were randomly allocated to the four dietary treatments each with three replications. Each farmer was treated as a replicate/receives a replication. The treatments are: T_1 (control or scavenging only), T_2 (30 gm (CRCMOLM (20 gm CRC and 10 gm MOLM)))+scavenging), T_3 (60 gm (CRCMOLM (40 gm CRC and 20 gm MOLM)))+scavenging) and T_4 (90 g (CRCMOLM (60 gm CRC and 30 gm MOLM)))+scavenging). The ratio to include CRC and MOLM was based on the formulation result of energy to protein ratio of 2800 kcal/kg DM to 16.5% CP. Salt was added 0.3% of the formulated ration and water was be provided ad lib.

Measurements and observations

The experiment was conducted for three consecutive months during which the egg production data was recorded. The amount of average feed consumed per bird was calculated as a difference between feed delivered to the farmer during the whole experimental period for each treatment and consumed by the chicken. Hens were weighed at the start and end of the experiment and BW change was calculated as the difference between the final and initial BW. Eggs were collected 3 times a day from each house early in the morning, afternoon and early in the evening. The sum of the 3 collections along with the number of birds alive on each day were recorded and summarized at the end of the period. The collected eggs were weighed every two weeks by the supervisors and average egg weight was computed by dividing the total egg weight to the number of eggs. Egg mass per hen was calculated as total egg weight divided by number of eggs and hens. Mortality was registered as it occurred and general health status was monitored throughout the experiment. It was also tried to assess the farmers' perception about the feeding system at the end of the trial. Monitoring and evaluation as a mini field day was also arranged at the end.

Statistical analysis

The data collected were subjected to statistical analysis using randomized complete design and analyzed using the ANOVA option of the SAS software at a significance level of P<0.05 basis. The differences in the treatment means were compared by Tukey Kramer test [12]. The model used in the experiment was;

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

Where, Y_{ij}=is an observation (experimental unit)

μ=Over all means

T_i=the i^{th} treatment effect

e_{ij}=random error term that incorporates all other sources of variation

Results and Discussion

The chemical composition of CRC is rich in energy and low in protein whereas MOLM can be a good source of protein (Table 1). The metabolizable energy (ME) level of CRC was high (3760 kcal/kg DM), it can supply the energy requirements of the birds. *Moringa oleifera* leaf meal had an optimum crude protein content (27.8%) and it can be used as a source of protein for poultry. Because cassava has a reasonably coppicing ability to grow everywhere and has a high in energy value, it may supply the energy requirement of the scavenging birds even during the rainy season. Moringa leaf is also grow at side line of the farm or back yard, it might also support protein requirement of the village birds.

The average supplement consumption by chickens in each household is given in Table 2, and total consumption of supplemented feed for the entire period was 0.00 kg, 2.60 kg, 5.04 kg and 6.48 kg for treatments 30 gm CRCMOLM (20 gm CRC, 10 gm MOLM); 60 gm CRCMOLM (40 gm CRC, 20 gm MOLM) and 90 gm CRCMOLM (60 gm CRC, 30 gm MOLM), respectively. There was a highly significant (P<0.05) difference in feed intake between the treatments concerning combined feed ingredients. The egg mass (number of eggs X weight) and egg weight analyzed were showed a non-significant (P>0.05) differences. The effect of the different supplementation treatments on body weight change shown in Table 2 also revealed a no difference (P>0.05) among the treatments.

Nutrient	CRC[1]	MOLM[2]
Dry Matter (%DM)	90.98	91.00
Crude Protein (%DM)	2.34	27.80
Crude Fiber (%DM)	0.32	6.78
Ether Extract (%DM)	0.83	6.60
Ash (%DM)	2.91	12.00
Metabolizable Energy (kcal/kg of DM)	3760	2785
Calcium (%DM)	0.03	0.78
Phosphorus (%DM)	0.03	0.31
[1]Cassava root chips; [2]Moringa oleifera leaf meal		

Table 1: Analyzed chemical composition of feed ingredients used to supplement the scavenging feed.

Parameters	Treatments				
	T_1	T_2	T_3	T_4	SEM
Total feed intake (kg/bird)	0.00^d	2.60^c	5.04^b	6.48^a	1.70.00
Egg weight (gm)	50.77	52.88	49.99	54.44	1.45
Egg mass (gm)	942.10	547.20	559.30	503.80	119.20
BW change (gm/bird)	0.70	0.24	0.15	0.32	0.11
^{a,b,c,d} Means within a row with different superscripts differ significantly (P<0.05); T_1: Scavenging only; T_2: diet containing 30 gm CRCMOLM (20 gm CRC, 10 gm MOLM); T_3: diet containing 60 gm CRCMOLM (40 gm CRC, 20 gm MOLM); T_4: diet containing 90 gm CRCMOLM (60 gm CRC, 30 gm MOLM).					

Table 2: Total feed intake, body weight change and egg laying performances of 24-36 weeks-old scavenging hens supplemented with cassava root chips and *Moringa oleifera* leaf meal.

Cassava root chips appeared to be rich source of energy even though low in fiber, protein, ash and ether extract. The high ME content of CRC noted in this study is indicative of its potential to supplement the scavenging system especially during energy feed dearth period in the diets of scavenging chickens. In agreement with results of the present study, high levels of ME in CRC have been reported previously [13,14]. The present result in terms of egg mass is not in agreement with different on-farm feeding trials with local birds [1]. The non-significant difference among the treatments in terms of these parameters might be the potential of the scavenging feed resource in the studied villages that might equally support the nutrient required to support consistent body weight, egg production and egg weight. That means it was sufficient enough with flock size during the study period to supply nutrients required for these parameters equally with groups of birds that supplemented and un-supplemented one.

Farmers' perception in the area

According to simple survey questioner performed with the participated farmers of the feeding trial, almost all of the participant farmers raised questions to get these kinds of improved technologies like breed, feed and health packages. The feed supplements like cassava and Moringa can be grown in backyard side line, the researcher advised and the farmers accept.

Monitoring and evaluation

From the mini field day arrangement, it was observed that most invited participants enjoyed the farm field with improved chicken breed and feed technology as it was the first in the area out of crop technologies,

Conclusion and Application

- White feather chicken is a synthetic chicken breed being developed by researchers at DZARC. From this study the breed showed a promising performance under semi-confined system.
- Supplementation of scavenging chicken in the villages of the study site at the time of the research was not imparted a difference or greater performance of the chicken.
- The scavenging feed resource base in that particular area was good enough to support the requirements of the birds. However, the sufficiency of the feed resource base and the cost of feed supplements should also be studied using more number of chickens or flock size.

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