

Effects of soybean and maize bran supplementation on carcass yield of local chickens under scavenging condition in mkwinda EPA, lilongwe, malawi

Abstract

An evaluation study on effect of supplementation on carcass yield of indigenous chicken was carried out at Mkwinda Extension Planning Area (E.P.A), Lilongwe. A total of thirty six chickens (18 cocks and 18 hens) were selected randomly from different clusters and were kept under scavenging system. The chickens were wing tagged for identification and allocated to three treatments [simple ration (89% maize bran, 10.75% soybean meal and 0.25% salt), maize bran and scavenging only as a control] under complete randomized design. The feedstuffs were analyzed for crude protein, crude fiber, ether extract, and dry matter before experiment. The supplementation was done in the morning and evening but age was not considered. The normal feathered chickens were selected for this experiment because they were mostly found in this EPA. Data collected included live weights, hot carcass dressed weight, cold carcass weight and visceral organs and parts. The results showed that simple ration significantly had highest live weights (1298g), hot carcass dressed weight (1098g), cold carcass weight (899.68g) amongst all the treatments; scavenging live weights (998.25g), hot dressed weight (801.125g), cold carcass weight (776.13g) and maize bran only live weights (1100g), hot dressed weight (1060.8g), cold carcass weight (899.43g). The same trend was observed in weights of visceral organ parts. It was also observed that cocks had higher carcass and organ yield compared to hens in all the treatments. It is concluded that supplementing indigenous chickens under scavenging conditions with simple ration result in more carcass and organs yield. Therefore farmers should be supplementing indigenous chickens by formulating simple ration for better carcass yield in indigenous chickens.

Keywords: Carcass, indigenous chicken, lilongwe, treatment

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Introduction

Village chickens are an important source of high-quality protein for the ever increasing rural and urban population and further provide the former with additional income, especially to the resource-poor communities.¹ Village chickens in Africa are in general hardy, adaptive to rural environments, survive on little or no inputs and adjust to fluctuations in feed availability.² Village chickens have a natural tendency to scavenge for their food resources. There has been a renewed enthusiasm in animal products that come from organic systems or the so called 'natural' systems. The recognized importance of village chickens in providing meat, cash income, socio-cultural values to rural people and their efficient scavenging system has led to increased research on the species during the past years.³

The scavenging feed resource base (SFRB) is defined as those feed resources available at farm level that consists of household refuse and all the materials available in the immediate environment that the scavenging birds can use as feed.¹ The major feed sources for village chickens are worms, insects, seeds, green leaves and other plant materials available in the backyard.⁴ According to,⁵ grains, bran and household food leftovers are occasional sources of supplementary feed in purely free-ranging systems. The SFRB for village chickens varies immensely with season, climate and location. This has been reported in studies conducted in countries such as Ethiopia, Indonesia,

Sri Lanka and Tanzania.^{6,7,4} Although not clearly estimated, sufficient SFRB may be available to scavenging village chickens in the rainy season, but there is scarcity when it is dry, especially during the spring season when there are less crop residues and the plants are beginning to sprout. In the rainy season, insects/worms and green forage materials are in abundance whilst in the harvesting season there is a high supply of cereal grains and a low supply of green forages and insects/worms.^{4,1} However, there is little information regarding the carcass yield characteristics, of indigenous chickens. Therefore, this study will provide basic information on indigenous chicken in Malawi which then will assist farmers, researchers and policy makers for indigenous chicken's improvement programs in future.

Materials and methods

Study area

The study was conducted at Mkwinda EPA. Specifically Mkwinda, Kudowole and Kuchinani village. Each village had three clusters which were 1km apart to prevent the mixed up of the chickens from one cluster to another. Each cluster had a maximum of 12 chickens where by all experimental chickens were wing tagged for identification. According to age they were adults. Chickens used for study were from the clusters which were bought by the Indigenous Chicken Improvement Program (InCIP).

Experimental animals and design

Thirty six (36) chickens were randomly selected from the clusters. From each cluster at least four chickens were randomly selected based on their feeding system. These feeding systems were complete ration, maize bran and salt then control. The feed ration contains 89% maize bran 10.75% soybean and 0.25% salt. The chickens were starved overnight but water was provided for easy evisceration procedure and also to know their actual live weight, weighed and Slaughtered, de feathered manually and feathers were air dried to find their weight at Sakhula farm thereafter measurements were done using the electronic scale (Table 1).

Table 1 The way chickens were bought from the clusters (36 chickens)

Treatments	Hens	Cocks	Total
Scavenging only	5	7	12
Maize bran only	6	6	12
Simple ration	7	5	12
	18	18	36

Data collection

The data collected was based on the live weight, sex by observation, live weight of the chickens; weight of feathers, Weight of empty gizzards, empty intestines, thighs, heads, breast muscles, wings, blood, liver, necks, hot dressed, back portion, drumstick wing, cold dressed weight, weight after bleeding, drumstick, empty crop.

Data analysis

The data collected was subjected to two ways ANOVA of the Statistical Packages for Social Science (SPSS) package considering effects of feeding system, Turkey's test, descriptive statistics, and estimated means was used to compare the means at the level of significance of $P < 0.05$ (Table 2).

Table 2 The approximate analysis

Feed	CP%	CF%	EE%	DM%
Simple ration	14.42	66.36	15.83	4.08
Control	-	-	-	-
Maize bran	10.03	63.16	19.21	5.24

Statistical model

$$Y_{ijk} = \mu + M_i + S_j + (MS)_{ij} + e_{ijk}$$

Where;

- Y_{ijk} = Observed carcass yield characteristics
 μ = Overall mean of the observation
 M_i = Effect of feeding systems on meat yield
 S_j = Effect of the sex on carcass yield
 $(MS)_{ik}$ = Interaction effect of the i^{th} feeding systems and the j^{th} sex
 e_{ijk} = Random error component

Results and discussion

The effect of feed on carcass yield

Effect of feed on carcass characteristics were also significant ($P < 0.05$) as summarized in (Table 3). Feed significantly ($P < 0.05$) affected all the parameters measured. The experiment further revealed that cocks showed remarkable and better carcass yield than hens for all the traits measured (Table 3). A two way ANOVA was conducted that examined the effect of feed and sex on meat yield. There was statistically significant difference on live weight, cold dressed weight after de feathered and weight after bleeding of hens and cocks on simple ration followed by those on maize bran then control meaning that feed had an effect on live weight cold dressed weight, weight after de feathered and weight after bleeding. The above results indicate that supplementing the indigenous chickens improves the performance of the chickens in terms of the meat yield as well as growth rate.

Because of its movement, indigenous chickens require more energy in search of the feed, they consume additional energy feed for scavenging activities and stop feeding when the crop and gizzard are filled to capacity (nibbling).⁸ Since village chickens mainly scavenge in order to obtain feed, the scavenging feed resources are not concentrated enough in terms of energy because they do not contain sufficient quantity of starch and they have high fiber content. Cereals have high amounts of crude fiber and cellulose (20-30%).⁹ According to Theerachai¹⁰ reported that male normal feathered indigenous chicken cocks had higher proportion of total carcass due to sex differences which arises due to physiological activities where hens involved in egg laying activities which requires high energy and reduce their weights compared to cocks. Furthermore, supplementing village chickens with commercial feed tend to give them intramuscular fat and resulting in better sensory attributes.¹¹ Consumers' preferences for village chicken meat is attributed to leanness, flavor and presumed organic origin than broilers (Table 4).

Results in Table 4 showed that there was high significant difference ($P < 0.05$) of chicken parts on those chickens under simple ration followed by those on maize bran and control meaning that simple ration had an effect on chicken parts. The above means of the thigh, breast muscle, back portion, drum stick and drumstick wing of chickens (cocks) under simple ration were high compared to those means of cocks on the maize bran and control, meaning that simple ration had an effect on chicken parts on cocks the same trend occurred in hens under simple ration, maize bran and control. Meaning that when the local chickens under free range are supplemented with simple ration there is much yield of chicken parts compared to those on the full scavenging and those on maize bran, when the local chickens are supplemented with the feed contain the protein it improves the productivity of the local chickens according to Theerachai.¹⁰ Rearing chickens with full feed supplements result in village chickens with high percentage of breast muscle, which was tenderer and of a better quality than muscle from an extensive system.¹¹

Table 5 indicates the visceral organs and there means, the means of empty gizzards, empty intestines and liver of chickens under simple ration were high compared to those on maize bran and control meaning that simple ration had an effect on the visceral organs and there was high significant difference ($P < 0.05$) on visceral organs under simple ration followed by those on maize bran and control, because after analysis there was correlation of results of visceral organs under

maize bran and control ($P<0.001$) toward to significant difference. There were much of these correlations because when chickens are supplemented or changed to another feed the gizzard tends to increase in size for digestion of the feed, this is so because gizzard helps grinding the feed. The empty intestines tend to have high weights

due to the processes of absorption. Based on literature according to Aderemi¹² found that the percentage of gizzard of indigenous chicken was higher than in broilers and that this may be due to the work load required to grind the feed particles of different nature available to the birds in scavenging system.

Table 3 The effect of feed on carcass yield (mean±SE)

Parameter	Control	Simple ration	Maize bran
Hens			
Live weight	998.25±0.49 ^c	1297.43±0.470 ^a	1099.4±0.470 ^b
Hot dressed wt	798.38±0.42 ^c	1094.39±0.410 ^a	899.8±0.410 ^b
Cold dressed wt	776.13±0.5 ^c	1048.57±0.458 ^a	881.4±0.458 ^b
After bleeding	973.75±1.213 ^c	1275±.986 ^a	1077±.973 ^b
DE feathered	948.625±1.233 ^c	1250±1.318 ^a	1052±1.560 ^b
Cocks			
Live weight	999±0.491 ^c	1298.8±0.470 ^a	1100±0.470 ^b
Hot dressed wt	801.125±0.498 ^c	1098.29±0.410 ^a	1060.8±0.410 ^b
Cold dressed wt	780.125±0.479 ^c	1079.57±0.458 ^a	899.43±0.458 ^b
After bleeding	977.750±0.996 ^c	1276±0.953 ^a	1078±0.953 ^b
De feathered	954.250±1.744 ^c	1251±1.560 ^a	1054±1.318 ^b

^{abc} means with different superscript within the rows are significantly different at $P<0.05$

Table 4 The effect of feed on carcass yield on parts (mean ±SE)

Parameter(g)	Control	Simple ration	Maize bran
Hens			
Drumstick	88.14±2.828 ^b	135.142±2.193 ^a	96.4±2.302 ^b
Thigh	99.75±1.669 ^c	186.429±2.370 ^a	157±2 ^b
Back portion	126.5±1.604 ^b	189.143±0.469 ^a	137.4±1.673 ^a
Breast muscle	128.25±0.109 ^b	136.143±0.206 ^a	130±0.668 ^b
Drumstick wing	57.25±2.375 ^b	93.286±0.175 ^a	68.6±1.673 ^b
Cocks			
Drumstick	88.5±0.691 ^b	136.14±0.660 ^a	96.4±0.660 ^b
Thigh	100.25±0.562 ^b	187.4±0.538 ^a	159±0.538 ^a
Back portion	128.75±0.957 ^b	196.8±0.924 ^a	138±1.915 ^b
Breast muscle	155.75±0.417 ^b	165.2±0.417 ^b	163.57±0.417 ^b
Drumstick wing	56.2±1.082 ^b	98.2±1.681 ^a	66.857±1.681 ^b

^{abc} means with different superscript within the rows are significantly different at $P<0.05$

Table 5 The effect of feed on carcass yield on visceral organs (mean ± SE)

Parameter(g)	Control	Simple ration	Maize bran
Cocks			
Empty gizzards	36.25±0.98 ^b	50.6± 0.94 ^a	38.57± 0.83 ^b
Empty intestines	36.5±.1.113 ^b	52.4±1.065 ^a	41±.1.065 ^b
Liver	24±.528 ^b	26.6± .505 ^a	25.285±0.505 ^b
Hens			
Empty gizzards	35.25±0.984 ^b	47.71±0.941 ^a	36.4±0 .941 ^b
Empty intestines	34.625±1.113 ^b	50.29±1.065 ^a	38.6±1.065 ^b
Liver	23.125± 0.528 ^b	26.123±0 .505 ^a	25.2±0.505 ^b

^{abc} means with different superscript within the rows are significantly different at $P<0.05$

Comparison of meat yield of cocks and hens on different supplements

After conducting the two way ANOVA to examine the effect of simple ration, maize bran and control on cocks under these treatments, the cocks showed the highest dressing percentage, cold dressing weight, weight after bleeding, weight after de feathered ($P<0.05$) compared to cocks on maize bran and control on the same parameters. The same trend occurred on hens under both treatments. According to Theerachai¹⁰ reported that male normal feathered indigenous chicken cocks had higher proportion of total carcass. But still there was slight difference on hens under simple ration and maize bran in terms of their weights showing that the energy that are stored in the body are used for the movement to search feed for those hens under control but those hens under simple ration and maize bran they had enough energy and the movement in search of feed was limited and the body was able to convert the stored energy into usable resources such as fat, that is why their weights were high compared to those on control. The results indicate that although hens undergo physiological activities such as egg laying, when the feed is available they still maintain their weights since the energy and proteins used during these physiological activities are replaced with the feed supplemented hence the meat yield of hens under scavenging were improved. Stocking density is an important factor that governs the birds' ability to exercise and this has an effect on the bird's energy utilization.

The low stocking density under outdoor production systems increases the birds' ability to exercise through exhibiting natural behaviors like walking, scratching and wing flapping.¹³ These activities favor myogenesis instead of lipogenesis¹⁴ because protein synthesis is stimulated by the increased activity.¹⁵ Based on results findings in this experiment indicates that when cocks and hens are supplemented with feed containing protein and energy will improve the meat yield and quality of meat. To have more yield in local cocks and hens farmers need to do supplementation using complete feed doing this will help them to get more profit.

Comparison of meat yield of parts between the cocks among different supplements

After conducting the two way ANOVA to examine the feed supplementation on chicken parts of cocks, it indicates that drumstick, thigh, back portion, breast muscle and drumstick wing under simple ration were high compared to those on maize bran and control meaning that simple ration had an effect on chicken parts of cocks and there was high significant difference ($P<0.05$) compared to those on maize bran and control. The same trend occurred in hens under both treatments. Chickens under scavenging conditions they stimulates a hypertrophic muscular growth of thigh and breast muscle that's according to Dransfield et al.¹⁵ The results are similar with the findings of Castellini et al.¹⁴ who reported that the breast meat increased when birds were managed at a lower stocking density in outdoor management systems. Since birds under scavenging conditions are more adapted to stress conditions than the confined counterparts, this could reduce pre-slaughter stress thus conserving more glycogen in the muscles. Meat with a lower ultimate pH has been reported to have a longer shelf life because low pH increases the lag phase time of psychrotrophic bacteria that are known to spoil meat^{16,17} (Table 6).

The two way ANOVA showed that there was correlation of results of empty gizzard, liver, and empty intestines of those cocks under

simple ration and maize bran at significant level of $P<0.05$ and there means were high meaning that simple ration and maize bran had an effect on visceral organs. The same trend occurred in visceral organs of hens. According to Aderemi¹² found that the percentage of gizzard of indigenous chicken was higher than in broilers and that this may be due to the work load required to grind the feed particles of different nature available to the birds in scavenging system and Tamilvanan¹⁸ reported that the weight of liver of indigenous chickens was higher than in broilers which could be due to increased metabolic activities in an effort to make up for the reduced availability of protein as the indigenous chickens are reared in free range system (Table 7).

Table 6 Comparison of visceral organs of cocks and hens on different supplements (means \pm SE)

Parameter(g)	Control	Simple ration	Maize bran
Cocks			
Empty gizzards	36.25 \pm 0.98 ^b	50.6 \pm 0.94 ^a	38.57 \pm 0.83 ^b
Empty intestines	36.5 \pm .1.113 ^b	52.4 \pm 1.065 ^a	41 \pm .1.065 ^b
Liver	24 \pm .528 ^b	26.6 \pm .505 ^a	25.285 \pm 0.505 ^b
Hens			
Empty gizzards	35.25 \pm 0.984 ^b	47.71 \pm 0.941 ^a	36.4 \pm 0 .941 ^b
Empty intestines	34.625 \pm 1.113 ^b	50.29 \pm 1.065 ^a	38.6 \pm 1.065 ^b
Liver	23.125 \pm 0.528 ^b	26.123 \pm 0 .505 ^a	25.2 \pm 0.505 ^b

abc means with different superscript within the rows are significantly different at $P<0.05$

Table 7 Interaction of feeding and sex on carcass yield characteristics (Mean \pm SE)

Parameter(g)	Feeding	Sex	Mean(\pm SE)	SIG
Live weight	Control	Male	999 \pm .491	*
		Female	998.25 \pm .491	
	Simple ration	Male	1298.8 \pm .470	
		Female	1194 \pm .462	
	Maize bran	Male	1100 \pm .470	
		Female	1099.4 \pm .429	
Hot carcass	Control	Male	798.5 \pm .429	*
		Female	780.125 \pm .429	
	Simple ration	Male	1098.236 \pm .410	
		Female	1092.286 \pm .515	
	Maize bran	Male	899.429 \pm .410	
		Female	879.8 \pm .390	
Cold carcass	Control	Male	781.29 \pm .479	*
		Female	780.125 \pm .429	
	Simple ration	Male	1079.4 \pm 1.949	
		Female	1070.57 \pm .458	
	Maize bran	Male	881.57 \pm .458	
		Female	879.4 \pm .458	

Table Continued

Drumstick wing	Control	Male	56.25±1.758	*
		Female	57.25±1.681	
	Simple ration	Male	98.2±1.681	
		Female	93.29±1.681	
Breast muscle	Maize bran	Male	68.85±1.758	*
		Female	66.6±1.673	
	Control	Male	155.2±.417	
		Female	130.25±.436	
Thigh	Simple ration	Male	165.75±.417	*
		Female	125.14±.436	
	Maize bran	Male	163.57±.417	
		Female	96.4±2.302	
Drumstick	Control	Male	100.25±.565	*
		Female	99.75±.669	
	Simple ration	Male	187.4±.538	
		Female	186.429±.538	
Back portion	Maze bran	Male	159±.538	*
		Female	157±.538	
	Control	Male	88±.691	
		Female	86.5±.690	
Thigh	Simple ration	Male	135.4±.660	*
		Female	86.68±.070	
	Maze bran	Male	96.286±.660	
		Female	94.4±.660	
Drumstick	Control	Male	137.75±.957	*
		Female	128.4±1.673	
	Simple ration	Male	196.8±1.924	
		Female	189.143±.105	
Back portion	Maze bran	Male	138±1.915	*
		Female	126.5±1.604	

**=Very significant, *=significant, NS=Not significant

A two way ANOVA was conducted that examined the effect of sex and feed on meat yield. There was a statistically significant interaction between the effect of sex and feed on meat yield $P < 0.05$ level. Consistently higher weights found in various carcass parameters in normal feathered males of Malawian chickens than in normal females is consistent with Isidahomen et al.¹⁹ who found similar results in Nigerian indigenous chickens reared under both free range and intensive systems. It has also been reported that sex differences were usually due to differences in hormonal profile, aggressiveness and dominance especially when both sexes are reared together.²⁰ In their report, Adedeji et al.²¹ stated that the aggressiveness of males over the females especially when reared together put the females at a disadvantage for feed and water. According to Musa et al.²² growth and carcass differences between cocks and hens were due to differences in feed metabolism and in the onset of fattening. From the results

it shows that the cocks that were on simple ration and maize bran had more meat yield and better quality compared to females on both feeding systems but those hens under complete feed had more yield compared to the cocks on control.

Conclusion

Supplementing indigenous chickens under scavenging conditions with simple ration (Soybean meal, maize bran and salt) result in more carcass and organs yield. It was also observed that cocks had higher carcass and organ yield compared to hens in all the treatments. Therefore farmers should be supplementing indigenous chickens by formulating simple ration (89% maize bran, 10.75% soybean meal and 0.25% salt).

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Conflict of interest

Authors declare that there are no conflicts of interest.

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