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*Research Article*

# Comparison between local concentrate mixed with phytogetic feed additives and imported concentrate on the performance, carcass characteristics of broiler chicks

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## Abstract

The experiment was designed to compare effects of Local Concentrate (LC) mixed with Phytogetic Feed Additives (PFA) and Imported Concentrate (IMC) on the performance, carcass characteristics of broiler chicks (Hubbard F15). A total of one hundred sixty unsexed, one day-old of broiler, the birds were offered an isocaloric and isonitrogenous experimental diets for 7 weeks. The data were analyzed by analysis of variance (ANOVA) for a completely randomized design. Four dietary treatments were formulated as follow: diet A contained 5% IMC (control), diets B, C, and D contained 2.5%, 5% and 7.5% LC, respectively. The LC was prepared by mixing 0.45% of clove (*Syzygium aromaticum*), 0.45% of ginger (*Zingiber officinale*), and 0.45% cardamom (*Elettaria cardamom*) to 34% groundnut cake, 11% sesame cake, 20% fish meal, 3% alfalfa meal, 28% cowpea, 0.4% limestone, 1% di-calcium phosphate, 1% salt, 0.25% vitamins. The parameters measured were Feed Intake (FI), Weight Gain (WG), Live Body Weight (LBW), feed conversion ratio (FCR), carcass characteristics. Mortality rate and economical appraisal. The analysis revealed that LC contained 96.5% DM, 34.7% CP, 7.5% CF, 14.2% Ash, 5.7% EE and 2543 Kcal/kg metabolizable energy. The results revealed that birds fed LC decreased significantly ( $P < 0.05$ ) the overall performance (FI, WG, LBW, FCR, dressing %) compared to the birds fed control diet. Substitution of LC with IMC was not recommended in broiler diets according to the levels used in the study. Further studies are needed with high levels of LC.

**Keywords:** Local concentrate (LC) mixed with phytogetic feed additives (PFA), Performance, Carcass characteristics.

## INTRODUCTION

Farm animal populations are undergoing continuous selection to improve the economic efficiency of animal production, in order to meet market and international health organization demands (Svitakova *et al.*, 2014). Concentrates have been used till now in poultry production due to its vital

role to complete the protein and microelements in poultry feeds so, to maximize the growth performance of birds. Today the poultry industry, in Sudan faced, feed crisis because of high cost of production which attributed to raise of cost of feed ingredients mainly imported concentrates. Now there were many attempts from nutritionists to replace the imported concentrate with different locally available

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protein sources completely replaced imported concentrate by synthetic lysine, methionine and Fishmeal they recorded significantly improvement on the chick's performance (Omer, 2001). Fishmeal is a natural balanced feed ingredient that is high in protein, energy, minerals and vitamins. During the last decade, herbs and phytogetic compounds have attracted a lot of attention for their potential role as alternatives to Antibiotic Growth Promoters (AGPs) in monogastric animals; (Mohamed Nabil Alloui *et al.*, 2014). Some studies proved that it was possible to formulate a successful local concentrates which was nutritionally optimal and economically feasible (Khalid *et al.*, 2015; Mukhtar and Mohamed, 2014). Therefore, the present study aimed to assess the comparison between local concentrate mixed with PFA (clove, ginger, cardamom) and imported concentrate on the broilers performance in terms of:

- Feed intake, weight gain and feed conversion ratio
- Carcass characteristics
- Blood constituents
- Profitability

## MATERIALS AND METHODS

The experiment was carried out in the Faculty of Animal Production, University of Khartoum, in the Poultry Experimental House, Unit Premises at Shambat during the period from 30/4/2017- 21/6/2017 (minimum and maximum temperatures were 29 and 45°C, respectively).

## DIETARY INGREDIENTS

The rest of ingredients such as sorghum, groundnut cake, sesame cake, super- concentrate, limestone, di-calcium phosphate, salt, premix, lysine and were purchased from the local market and veterinary centers. Local concentrate ingredients:

The ingredients local concentrate such as groundnut cake, sesame cake, fishmeal, alfalfa, cowpea, limestone, di-calcium phosphate, salt, vitamins, were purchased from the local market and veterinary centers. The spices (clove, ginger, cardamom) used in this experiment was obtained from Omdurman market and then milled.

## PROCESSING OF LOCAL CONCENTRATE

The dried clove, ginger, cardamom, alfalfa, cowpea, was milled to be mix in localconcentrate for broiler diets. The clove, ginger, and cardamom mixed by the levels (1:1:1). Sample of local concentrated were analysis according to AOAC method of analysis (1990) for proximate chemical composition Table (4).

**Table 1:** The ingredients composition of local concentrate.

Ingredients	Levels of ingredients %
Groundnut	34
Sesame meal	11
Alfalfa Meal	3
Cowpea meal	28
Fish meal	20
Limestone	0.4
Dicalcium phosphate	1
Nacl	1
Vitamins	0.25
Cardamom	0.45
Clove	0.45
Ginger	0.45
Total	100

**Table 2:** Calculated chemical composition of local concentrate.

Items	Local concentrate chemical composition
<b>Calculated composition</b>	
Crude protein	35.09
Crude fiber	6.78
Lysine	4.49
Methionine	1.76
Calcium	8.42
Available phosphorus	4.02
(ME) kcal/kg	2539

**Table 3:** Ingredient composition of experimental diets (%).

Ingredient	Local concentrate levels (%)			
	0.0	2.5	5.0	7.5
Sorghum	66.65	66.0	66.65	66.65
Groundnut	16.0	17.0	16.0	15.0
Sesame meal	11.0	12.0	11.0	10.0
*Super concentrate	5.00	0.00	0.00	0.00
Dicalcium phosphate	0.3	1.3	0.3	0.1
L.Stone	0.3	0.45	0.3	0.00
NaCl	0.25	0.25	0.25	0.25
** Premix	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Total	100	100	100	100

## EXPERIMENTAL BIRDS

A total of 160 one-day old, unsexed commercial broiler chicks (Hubberd F<sup>15</sup>) were purchased from commercial company, on arrival all chicks were weighted and distributed randomly in to 16 floor pens in a completely randomized design (10/pen). The mean initial weight for chicks in each pen was approximately equal about (36-43); pens were then divided randomly among four experimental diets.

### Experimental diets

Four experimental diets were formulated from local

ingredients (Table 6-35) the diets were approximately isocaloric and iso-nitrogenous supplemented to meet NRC requirements (NRC, 1994), with different levels of local concentrate by level (0.0%, 2.5%, 5.0% and 7.5 %). Chicks were assigned randomly to the dietary treatments. Diet A–0.0% level of local concentrate (Served as control which fed the imported concentrate), diet B- (2.5%), diet C- (5.0%) and diet D- (7.5%). The calculated analyses of experimental diets were present in Table (4), ingredients compositions of experimental diets were shown in Table (3).

\* Commercial concentrate contains %: CP 35, Lysine 11.5, Methionine 4.5, and Methionine + Cystine 4.9, Calcium 3, Phosphorus 4.5, and ME 2000 Kcal/ Kg.

\*\* Premix provided per Kg of experimental diets: Vitamin A 250.000 IU, Vitamin D3,50.000 IU, Vitamin E 500 mg, Vitamin B1=20mg, B2=100, B3 160mg, B12 =5mg, K3=40mg, Cholin Chloride 4.000mg, Biotin 1mg, Folic acid 12mg, Niacin 600mg, Iron 1.200mg, Mn 800mg, Selenium, Co 1.600 mg, Zn300 mg.

### Experimental housing and equipment

The experiment was conducted in an open house long axis was situated in an east west direction. The shed was 18×16 square meters, with height of 3.5 m constructed of iron posts with netted short brick wall 60 cm, iron material roof, concrete floor and wiremesh in all sides. The house partitioned into sixteen pens each of them one meter dimension. Before the commencement of the experiment the house was cleaned and burned then disinfected with formalin and then 16 pens one square meter for each replicate were selected for this experiment. Each pen was provided with clean disinfected feeders and drinkers, dry wood shavings were used as a litter material. Light was provided for 24 hours in the form of natural light and supplemented with artificial light in the evening. Sixty watt bulb was used in

each four pen, during the whole period and then the birds were distributed randomly among 16 pens equally (ten birds in each).

## MANAGEMENT AND DATA COLLECTION

### Management and medication

All birds were vaccinated against Newcastle Disease (ND) and infectious Bronchitis Disease (IB), at seven day old, using clone 30+IB strain. At fourteen days old birds were vaccinated against Gumboro disease using 78 strains in drinking water, and at twenty one day old also revaccinated against Newcastle disease using clone 30 strains in water.

### Performance data

Body weight, feed intake were recorded weekly, body weight gain and Feed Conversion Ratio (FCR) were estimated for the individual replicate of each dietary treatment. (Feed and water were offered *ad libitum*).

### Data of carcass and dressing% calculation

The hot carcass weight was recorded and dressing out percentage was determined by expressing hot carcass weight to live weight. Sixteen (carcass sample) from each dietary treatment two carcass/replicate, eight bird per treatment) were used to determine the proximate analysis for the meat and at the same time carried out the panel tests.

### Chemical analysis feed

Feed Samples (experimental diets) were approximately analyzed on dry matter basis for chemical component according to AOAC (1990).

### Economical study

The change in total feed cost, total revenue and profit for

**Table 4:** Calculated chemical composition and determinate analysis of experimental diets

Item	Local concentrate levels %				
	0.0	2.5	5.0	7.5	
<b>Calculated</b>	Crude protein	22.4	22.0	22.1	22.1
	Crude fiber	3.3	3.5	3.5	3.6
	Lysine	1.3	0.83	0.93	1.03
	Methionine	0.46	0.37	0.39	0.42
<b>Composition</b>	Calcium	1.03	1.04	0.95	0.97
	Available phosphorus	0.38	0.47	0.38	0.44
	(ME) kcal/kg	3138	3131	3160	3169
	CP%	18.98	19.1	19.1	19.1
<b>Determinate analysis</b>	CF%	4.7	4.6	4.5	4.6
	EE%	3.5	3.9	4.0	4.2
	Ash%	5.0	6.5	4.1	5.1
	NFE%	62.8	62.9	64.3	61.6
	(ME) kcal/kg	2958	2787	2790	2755

treatment diets containing local concentrate (0.0%, 2.5%, 5.0% and 7.5%) was calculated.

### Experimental designs and statistical analysis

The experiment was conducted following the completely randomized design. The data were subjected to analysis of variance (ANOVA) according to SPSS using computer programmer. Treatment means were separated by using Duncan multiple range test (DMRT).

## RESULTS

### The local concentrate chemical composition

Proximate chemical analysis and composition of local concentrate are presented in Table (5). The results revealed that local concentrate contained; 96.5% Dry matter, 34.7% Crude protein, 7.5% Crude fiber, 14.2% Ash, 5.7% Ether extract, 34.4% Nitrogen Free Extract (NFE), 2327 Metabolizable Energy (ME) kcal /kg.

Feed efficiency for the broiler fed local concentrate: Feed intake: Data on weekly feed intake, as affected by feeding local concentrate, is illustrated in Table (6), the presented results indicated that there were significant ( $P < 0.05$ ) difference in feed intake for the 2<sup>nd</sup>, 4<sup>th</sup>, 5<sup>th</sup>, 6<sup>th</sup> and 7<sup>th</sup> weeks. However, during the 1<sup>st</sup> and 3<sup>rd</sup> weeks the results revealed no

significant ( $P > 0.05$ ) effect of dietary treatment. The lowest feed intake obtained by the bird fed local concentrate when compared with the control group. Growth performance for broiler fed local concentrate:

### Body weight

In the present study the effect of used local concentrate on weekly weight was presented in Table (7). There was significantly ( $P \leq 0.05$ ) difference on the body weight among all treatments. The birds fed tested diets obtained the lowest weight gain when compared to control group which fed the commercial imported concentrate.

### Weight gain

The mean of weekly weight gain by dietary treatments during 7 weeks of experiment is presented in Table (8). There was significantly ( $P \leq 0.05$ ) decreased in the weight gain among the different treatments for the all weeks by the feeding local concentrate. The control group which fed the commercial imported concentrate had the highest weight gain compared to the other groups.

### Feed conversion ratio

Treatment means for FCR (kg feed consumed/kg body weight gain) of broiler chicks are demonstrated in Table (9). The results showed no significant ( $P > 0.05$ ) differences in FCR among all dietary treatments throughout the 2<sup>nd</sup>, 4<sup>th</sup>, and 7<sup>th</sup> weeks. However there were significantly ( $P < 0.05$ ) difference for the 1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup> and 6<sup>th</sup> weeks. Whereas the FCR was improved for the last two weeks by feeding local concentrate.

### Overall performance for the bird fed local concentrate

The overall performance results of broiler chicks fed different levels of local concentrate are summarized in Table (10). The results recorded that there were significant ( $P < 0.05$ )

**Table 5:** Proximate analysis of local concentrate:

Ingredient	(%)
Dry matter	96.5
Crude protein	34.7
Crude fiber	7.5
Ash	14.2
Ether extract	5.7
Nitrogen free extract (NFE)	34.4
Metabolizable energy (ME) kcal /kg	2543

Calculated using the following equation according to Lodi *et al.* (1976).

$$ME = (1.549 + 0.0102 CP + 0.0275 EE + 0.0148 NEF - 0.0034 CF)$$

**Table 6:** Weekly feed intake (g) of broilers as affected by the feeding local concentrate.

Weeks	Local concentrate levels (%)				±SEM	Sing
	A (0.0)	B (2.5)	C (5.0)	D (7.5)		
1	82	70	69	73	5.17	NS
2	192 <sup>a</sup>	148 <sup>b</sup>	149 <sup>b</sup>	152 <sup>b</sup>	7.02	*
3	421	392	368	361	23.7	NS
4	289 <sup>a</sup>	161 <sup>b</sup>	163 <sup>b</sup>	134 <sup>b</sup>	26.5	*
5	903 <sup>a</sup>	598 <sup>b</sup>	650 <sup>b</sup>	532 <sup>b</sup>	54.5	*
6	706 <sup>a</sup>	371 <sup>b</sup>	351 <sup>b</sup>	334 <sup>b</sup>	33.0	*
7	740 <sup>a</sup>	412 <sup>b</sup>	365 <sup>b</sup>	378 <sup>b</sup>	51.2	*

- a, b, c: Mean values with different superscripts within a column differ significantly ( $P \leq 0.05$ ).
- NS = Non-significant difference ( $P > 0.05$ ).
- = Significant difference ( $P \leq 0.05$ ).
- SEM = standard error of the mean.

**Tables 7:** Weekly body weight (g) of broilers as affected by feeding local concentrate.

Local concentrate levels (%)						
Weeks	A (0.0)	B (2.5)	C (5.0)	D (7.5)	±SEM	Sing
1	98.5a	83.0b	78.5b	81.5b	3.7	*
2	215a	145b	137.5b	155b	8.6	*
3	422a	226b	225b	235b	12.4	*
4	635a	330b	340b	325b	18.1	*
5	1013a	520b	476b	464b	24.7	*
6	1298a	711b	629b	614b	45.3	*
7	1584a	848b	717b	734b	49.8	*

- a ,b, c: Mean values with different superscripts within a column differ significantly (P<0.05).
- NS =Non-significant difference (P>0.05).
- = Significant difference (P< 0.05).
- SEM = standard error of the mean.

**Table 8:** Weekly weight gain (g) of broilers as affected by feeding local concentrate for broiler diets.

Local concentrate levels (%)						
Weeks	A (0.0)	B (2.5)	C (5.0)	D (7.5)	±SEM	Sing
1	57a	43b	38b	42b	3.6	*
2	158a	103b	100b	114ab	6.2	*
3	207a	81b	88b	81b	8.4	*
4	214a	110b	115b	89b	11.3	*
5	378a	191b	145b	140b	17.2	*
6	283a	191b	173b	150b	29.1	*
7	288a	184b	160b	161b	34.4	*

- a ,b, c: Mean values with different superscripts within a column differ significantly (P<0.05).
- =Significant difference (P<0.05).
- SEM = standard error of the mean.

**Table 9:** Weekly feed conversion ratio of broilers as affected by feeding local concentrate.

Local concentrate levels (%)						
Weeks	A (0.0)	B (2.5)	C (5.0)	D (7.5)	±SEM	Sing
1	1.43b	1.8a	1.9a	1.8a	0.10	*
2	1.2	1.5	1.5	1.4	0.09	NS
3	2.03c	4.88a	4.15b	4.48ab	0.20	*
4	1.35	1.5	1.43	1.5	0.18	NS
5	2.4c	3.18bc	4.55a	3.9ab	0.32	*
6	2.58a	2.13bc	2.23a	2.33ab	0.35	NS
7	2.73	2.25	2.35	2.05	0.23	NS

- a ,b, c: Mean values with different superscripts within a column differ significantly (P<0.05).
- SEM = standard error of the mean.
- NS =Non- significant difference (P>0.05).
- \*=Statically significant (P<0.05).

decreased on feed intake, weight gain and feed conversion ratio (FCR) for the treated groups. The control group which feeding the commercial imported concentrate obtained the highest results.

### Mortality rate

Mortality was not affected by feeding local concentrate Table (11).

### Carcass and dressing% of the broiler fed local concentrate

Feeding of local concentrate had significantly (P>0.05) decreased final body weight, carcass weight, and dressing % Table (12). The best final body weight obtained by the bird fed control diet which feeding with the commercial imported concentrate. The birds fed local concentrate recorded the

**Table 10:** Overall performance (g) as affected by feeding local.

Local concentrate levels (%)						
Parameters	A (0.0)	B (2.5)	C (5.0)	D (7.5)	+SEM	Sing
Total intake(g)	1549a	860b	778b	759b	47.8	*
Total Gain(g)	3322a	2141b	2116b	1941b	126.2	*
FCR	2.1b	2.5ab	2.7a	2.6a	2.6	*

concentrate for broiler diets

- NS =Non- significant difference (P>0.05).
- SEM = standard error of the mean.
- \*=Statically significant (P<0.05).

**Table 11:** Mortality and live rate for bird fed local concentrate.

Local concentrate levels (%)				
Week	A (0.0)	B (2.5)	C (5.0)	D (7.5)
1	0	1	1	0
2	1	0	1	0
3	0	0	0	0
4	0	1	0	0
5	0	2	0	0
6	0	0	0	0
7	1	0	0	0
Total	2	4	2	0
Mortality rate r%	5	10	5	0
Live rate%	95	90	95	100

**Table 12:** Average of live weight carcass weight and dressing % of broiler fed local during seven weeks.

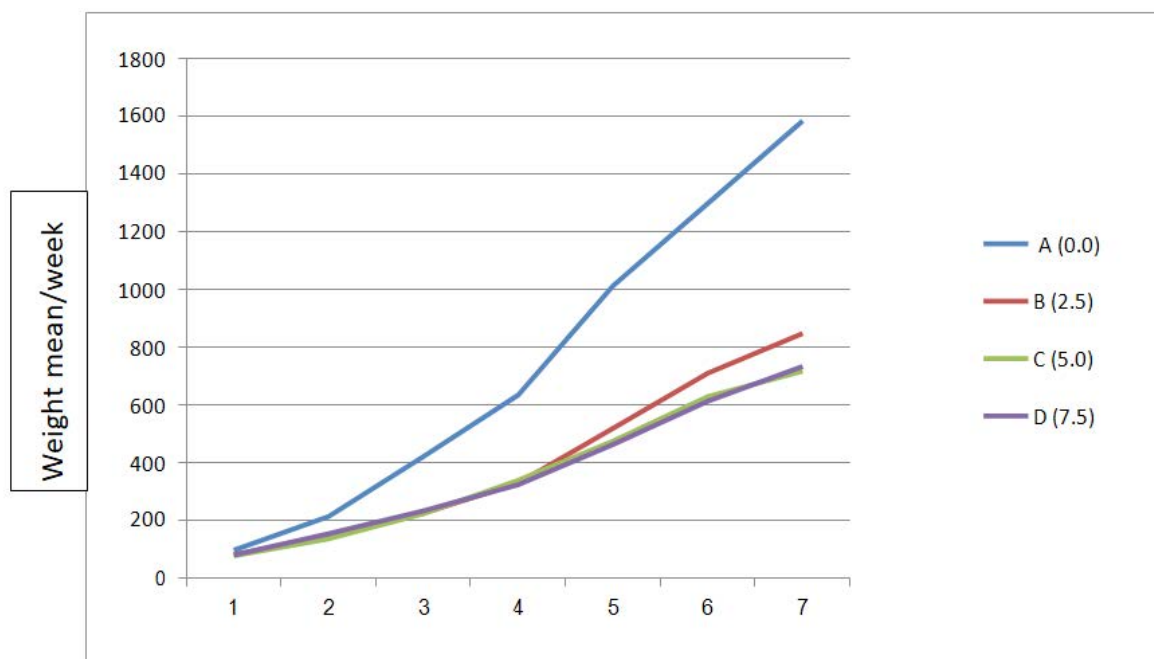
Local concentrate levels (%)						
Parameters	A (0.0)	B (2.5)	C (5.0)	D (7.5)	+SEM	Sing
Final body weight	1458a	922b	822b	839b	65.2	*
Carcass weight	952a	578b	472b	482b	56.1	*
Dressing%	65a	63b	57b	58b	2.71	*

- NS =Non-significant difference (P>0.05).
- SEM = standard error of the mean.
- \*=Statically significant (P<0.05).

**Table 13:** Feeding economics of the experimental groups for local concentrate:Total Costs.

Items	Local concentrate level%			
	0.0	2.5	5.0	7.5
Price of the bird(SDG)	285	270	285	300
Feed cost (SDG)	324	143.5	156.8	164
Management cost (SDG)	375	375	375	375
Total cost (SDG)	964	794	817	839
Total cost dollars	61.5	49.6	51.1	51.1
Costs/ bird(SDG)	25.9	22.1	21.5	21
<b>Total return</b>				
Average body weight (g/ bird)	952	482	472	482
Price of kg meat (SDG)	42	42	42	42
Total returns(SDG)	39.98	20.24	19.82	20.24
Profit /bird (SDG)	14.1	2.2	-1.7	-0.76
Profitability ratio/kg meat	1	0.15	-0.012	-0.054





**Figure 1:** Weekly body weight (g) of broilers as affected by the dietary local concentrate.

lowest results compared to the control group for the all period of the experiment.

### Feeding economics of the experimental groups

The major inputs and margin over major inputs/head of broiler chick fed different levels of local concentrate for 42 days is shown in Table (13), chick purchase and feed cost values (SDG) were considered the major inputs. The economical evaluation of the experimental diets indicated that the control diet having the highest Return/bird (SDG) (14.9) while the treatment diets showed the lowest Return/bird (SDG) (3.3, -1.2, -0.76).

## DISCUSSION

In the present study, the proximate chemical analysis and composition of local concentrate was presented in the Table (5). The overall performances for the bird fed local concentrate were significantly lowest and the control group which includes the commercial imported concentrate group gained the highest value. This might be due to: imported concentrate may include some substances or growth promoters or/and the use of the fishmeal by only (20%) or high percent (34%) of groundnut cake in local concentrate this results contradicted with Mukhtar and Mohamed, (2014); Khalid *et al.*, (2015); who reported that local concentrate can successfully replace the imported concentrate in the diet of broiler chicks. This contradictory could be related to their concentrate ingredients and the% of these ingredients, they used high percentage of fish meal and vitamin premixes

(52% and 16.0%) respectively. Moreover, the protein in fishmeal has a highly biological value in diets for animals (Pike, 1999); Karimi, (2006) who mentioned that fed diets with different protein sources or fishmeal improved broiler performance and the improvement affected with the level of fishmeal in the diet. Spices contains different molecules that have intrinsic bio-activities on animal physiology and metabolism (Kausar *et al.*, 1999; Jamaroz and Kamel, 2002; Cabuk, *et al.*, 2003; Ertas *et al.*, 2005; MA, 2006). All those researchers stated the effect of spices individual or mixture improved the overall performance of broiler but they are all used the commercial imported concentrate in treatment diets which was not applied in the present study. And the poor results for the local concentrate in this study might be associated with the little dose a mixture of spices per 100kg of local concentrate per 100kg of diets, or none addition of lysine and methionine (McDonald *et al.*, 1981; Jensen, 1991). The high levels of groundnut cake (34% per 100kg) local concentrate which may be contaminated by Aflatoxin that incurring economic losses to poultry industry (Rizzi *et al.*, 1998). The toxicity of Aflatoxin in poultry consists of anorexia, lethargy, poor production traits (live weight and weight gain), lower feed consumption, increased feed conversion and lethality (Kubena *et al.*, 1998; Ledoux *et al.*, 1999; Miazzi *et al.*, 2000). The feed contaminants according to the World Health Organization, at least one quarter of feedstuffs on a global scale are contaminated with mycotoxins. The high temperature in fields, physical and chemical damage by insects, improper storage conditions and the presence of broken grains are favourable factors

for mycotoxin accumulation in grains (Binder *et al.*, 2007). Carcass yield, dressing percentage of the birds fed on tested local concentrate had the lowest parameters; this may be caused to the lowest body weight and carcass obtained in this experiment this in line with the findings of Botsoglou *et al.*, (2002) and Dalkılıç, (2009). Mortality of experimental chicks was within normal range although chicks fed diets with 7.5% local concentrate recorded no mortality, this might be due to that fishmeal protect health and welfare, results were agreed with that of (Khalid *et al.*, 2015; National Research Council 1994).

## CONCLUSION

The use of local concentrate with a mixture of spices has not improved the overall performance. So it needs other researches in this field to determine the optimal use of inclusion levels of (PFA) in local concentrate for broiler diets by removing commercial imported concentrate, increase the level of fishmeal as a source of protein and reduce groundnut cake as local ingredient.

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