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LEAST COST HOMEMADE STARTER'S RATION EFFECT ON GROWTH PERFORMANCE OF INDIGENOUS AND SASSO BREED CHICKS

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AUTHORS' CONTRIBUTIONS

This work was carried out in collaboration among all authors. Authors LG and SD did the Conceptualization. Authors LG and FT did the methodology. Author LG did the software. Authors LG, SD and FT did the validation. Author formal LG did the analysis. Author LG did the investigation. Author FT did the resources. Author SD did the data curation. Author LG did the writing—original draft preparation. Author LG did the writing—review and editing. Author LG did the visualization. Author SD did the supervision. Author FT did the project administration. Funding acquisition, Ministry of science and higher education. All authors read and approved the final manuscript.

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ABSTRACT

The objective of this study was commercial starters ration substitution by least-cost ration in various levels on the growth performance of Indigenous and Sasso chicks in Farta Woreda. The research area is 666km far from the capital city of Addis Ababa, Ethiopia. A total of 150 Indigenous local and 450 Sasso T-44 day-old chicks were randomly assigned into five dietary groups, which contained 0% (T5), 25 (T4), 50 (T3), 75 (T2), and 100 (T1) of commercial starter's ration in factorial completely randomized design (CRD) with 3 replications for two months feeding period. The results showed that the commercial ration level decreased and the increased level of the least cost homemade ration was significantly low (p<0.001) retaining dry matter and nitrogen, mean daily feed consumption and metabolizable energy. On the opposing, there was an increase in fiber content and feed conversion ratio in high-level dilution of starter's commercial diet with a homemade diet. Yet, chicks on 0, 25, and 50% commercial starters rations groups substituted by homemade rations were significantly higher (p<0.001) in daily weight gain, feed conversion ratio, mean daily feed intake and final body weight attained. According to these results, up to 50% of expensive commercial starter rations were replaced by the least-cost homemade ration without adversely affecting the growth performance of chicks.

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1. INTRODUCTION

"In Ethiopia, chicken has an important socio-economic role to provide for family income, cultural ceremonies and human food for the society" [1]. "Backyard-based indigenous chicken poultry production is the main income-generating activity from the sale of eggs and live birds. It is also a source of self-reliance for women since the sale of eggs and live birds are decided by women [2], both of which provide women with a direct income to meet household expenditures such as food and cloth. Moreover, small-scale modern poultry is broadly kept in the urban and peri-urban populations" [3]. "Presently, the Ethiopian government has a plan to support jobless youths and vulnerable households through sponsored projects implemented by several Donors, FAO (Food and Agricultural Organization of the United Nation) and NGOs (Nongovernmental organizations) for small-scale poultry development. Unfortunately, the main bottleneck of both the small-scale modern and village poultry production system is poor quality and high cost of feed" [4].

"In Ethiopia, the only source of feed under the village production system is a scavenging feeding system and there is no purposeful feeding of chickens. The scavenging feed resource is varies in different seasons" [5,6]. "The most common ingredients for processed chicken feed are cereal grains, cereal grain by-products, and oilseed cakes and are largely found in and in the neighbourhood of larger towns" [5]. In addition, the lack of regional feed mills adds to the transportation cost to move the feeds to the site of production. Due to these reasons, the setup of feed packages aimed at developing least-cost regional poultry rations with the use of locally available feed resources is an unquestionable solution for both village and small-scale modern poultry production systems. Therefore, the specific objective of this study was;

1. To formulate the homemade least-cost starter's ration from locally available ingredients in South Gondar Zone of Amhara Regional State
2. To evaluate the homemade least-cost starter's ration on growth performance of Sasso breed and Indigenous chicks in the South Gondar Zone of Amhara Regional State
3. To assess the economic feasibility of the inclusion of the homemade starters rations into the village chicken production system.

2. MATERIALS AND METHODS

2.1 Experimental Dietary Treatments Formulation

Locally available feed ingredients were used to formulate the least-cost homemade ration and the commercial ration was used as a positive control. Sorghum, wheat, Maize, millet, wheat bran and barley grains were used as an energy source while Noug seed cake was used as a source of proteins. These were purchased from the local market and transported to the study area. However, the commercial starter's ration was purchased from the Andasa Ethio-chicken poultry farm and transported to the study site. Representative samples were taken from all the feed ingredients and the commercial starters' rations and milled to pass through a 1mm sieve, and stored in airtight bags until required for laboratory analysis. The Crude protein (CP), crude fat (CF), dry matter (DM), ether extract (EE), crude fiber (CF), and total ash were determined according to [7]. The metabolizable energy (ME) content of all the samples were estimated using regression and summation equations [8,9]. Based on the laboratory analytical data, a leas-cost homemade starter's ration was formulated as shown in Table 1. The least-cost homemade starter's ration was formulated and contained 2955 kcal/kg of energy and 19.39% proteins, using win feed 2.8 version of 2018 software.

2.2 Management of the Experimental Chicks

Before the commencement of the experiment, household participants were selected and hay box brooders were constructed from locally available materials as suggested by [10]. A total of 150 Indigenous local day-old chicks were hatched with the use of 15 thoroughly broody hens and 450 Sasso T-44 breed day-old chicks were purchased from the Andasa Ethio-chicken poultry farm. All the groups of chicks were transported and randomly offered to selected and well-trained households that have cleaned, disinfected and well-prepared hay box brooders. The chicks were individually weighed and vaccinated against Gumboro, Newcastle Diseases and Marek's diseases. All the day-old chicks were assigned into five groups. Finally, as presented in Table 2 the chicks were assigned to five dietary treatments each with 90 Sasso T-44 and 30 Indigenous chicks respectively in a factorial completely randomized design with 3 replications. Body weights were taken weekly whereas feed consumption was measured daily throughout the experimental periods.

Table 1. Experimental ration composition

Feed Ingredients	Ingredients composition/proportion/				
	T1	T2	T3	T4	T5
Noug seed cake	0	5.8	11.6	17.4	23.2
Wheat bran	0	6.1	12.2	18.3	24.4
Sorghum grain	0	1.2	2.4	3.6	4.8
Maize	0	8.2	16.4	24.6	32.8
Wheat grain	0	2.2	4.4	6.6	8.8
Barley grain	0	0.3	0.6	0.9	1.2
Millet grain	0	1.2	2.4	3.6	4.8
Commercial feed	100	75	50	25	0

T1=0% least cost diet; T2=25% least-cost diet; T3=50% least-cost diet; T4=75% least-cost diet and T5=100% least cost diet

Table 2. Experimental chicks arrangement in five treatments

Dietary Treatments	Sasso Chicks per treatment.	Indigenous chicks/Tr.	Rep/Tr.	Sasso/ Rep	Indigenous /rep
100% Commercial starter's diet (T1)	90	30	3	30	10
75% Commercial + 25% Homemade starter's diet (T2)	90	30	3	30	10
50% Commercial + 50% Homemade starter's diet (T3)	90	30	3	30	10
25% Commercial +75% Homemade starter's diet (T4)	90	30	3	30	10
100% homemade starters diet (T5)	90	30	3	30	10

2.3 Data Collection

The feeding trial lasted for about 8 for Sasso and 24 weeks for Indigenous chicks. The main data collected covered was daily weight gain, feed intake, and final body weight and feed conversion ratio. The partial budget analysis was done according to [11] to determine the comparative economic feasibility of the homemade starters' ration and the commercial ration studied. For this economic analysis, feed cost, chick's market price, and profit was considered. By subtracting total variable cost (TVC) from the total return, the net income (NI) was calculated as equation 1.

$$NI = TR - TVC \quad (1)$$

The variance between total return (ΔTR) and total variable cost (ΔTVC) was given the change in net income (ΔNI) mathematically represented as follow;

$$\Delta NI = \Delta TR - \Delta TVC \quad (2)$$

The ratio of net income (ΔNI) related to each additional unit of expenditure (ΔTVC) was measured by the marginal rate of return (MRR) as expressed in the percentage (equation 3).

$$\%MRR = \frac{\Delta NI}{\Delta TVC} * 100 \quad (3)$$

2.4 Statistical Analysis Methods

The PROC GLM of the Statistically Analysis software SAS 9.2 version [12] was used to perform statistical analysis of variance on all of the data gathered. To find the treatment means, the Least Significant Difference (LSD) approach was utilized. The following model was used to test the growth performance of the chicken that is affected by types of breed, types of rations, and their interaction as indicated in equation 4.

$$Y_{ij} = \mu + B_i + Rj + \varepsilon ij \quad (4)$$

Where;

Y_{ij} = the i^{th} observation of i^{th} breed (B), the j^{th} ration (R),

μ =is the general mean

B_i= the effect of level *i* of factor breed (B)

R_j= the effect of level *j* of factor ration (R)

ε_{ij}= is the random error associated with Y_{ij} observation. (Mean was separated by using LCD)

3. RESULTS AND DISCUSSION

3.1 Chemical Composition of the Experimental Diet

The metabolizable energy contents and proximate analysis of the experimental rations are presented in Table 3. The crude proteins range between 18-20.9%, however, the dry matter of the treatment rations ranges between 91 and 94%. The homemade starter ration was higher levels of crude fiber recorded. Yet, the lowest crude fiber (4%) content was obtained from the commercial starter's ration followed by that of T2 and T3 respectively. The percentage composition of the ether extracts of the treatment rations tended to show that of the crude fiber contents. The metabolizable energy contents of the treatment rations are comparable and ranged between 2875 and 3035, all of which are above the requirement of the experimental chickens.

"The fiber content of the experimental ration was significantly (P<0.001) higher than [13] reported while different feed ingredients were used for ration formulation. The crude protein and energy content of the homemade least-cost ration in the current study was controversially low" [14]. "But had similar observations with the [15,16] report on the effect of the exogenous enzyme diet on broiler performance study. This happened due to the factors that affect the chemical composition of the ingredients like maturity level, harvesting season, soil type, and part of the ingredients" [17,18].

3.2 The Feed Consumption of Chicks

The results of the mean feed consumption of the experimental chicks are presented in Tables 4-6. During the first four weeks of the brooding period, the mean daily and weekly feed consumption of the indigenous chicks placed on all four treatments ration was significantly lower (P<0.05) than that of the Sasso T-44 (Table 4). Furthermore, throughout the first four weeks of the brooding period, the Sasso breed's mean total feed intake was considerably higher than the indigenous chicks. On the contrary, the mean daily and weekly feed consumption of the indigenous groups fed on homemade ration was significantly lower (<0.05) than the indigenous groups fed on either commercial or different combinations of commercial and homemade rations. As presented in Table 5, the Sasso treatment groups were significantly higher (P<0.05) than the indigenous chicken treatment groups in mean, daily, weekly and total feed consumption during the second 4 weeks of the brooding period. On the eighth week of the brooding period, the Sasso T-44 treatment groups and the indigenous treatment groups consumed 43 and 19 grams of feed per hour, respectively. The indigenous experimental chicks' feeding trial was extended beyond the 8-week brooding period. During the 9-24 week period of age, the indigenous groups fed on the commercial starter's ration consumed an average of 50g/h of feed. During the 9-24 week period, indigenous groups fed either 25, 50, or 75 percent commercial starter rations had a daily feed consumption of 41 g/h, whereas those fed homemade starter rations had a daily feed consumption of 33.9 g/h.

The mean daily feed consumption (MDFC), mean weekly feed consumption (MWFC), and mean total feed consumption (MTFC) for Indigenous fed homemade ration was significantly (p<0.001) lower than birds fed 25, 50, 75, and 100% commercial ration during the second four weeks (5-8 weeks). The MDFC, MWFC, and MTFC were significant (p<0.001) among the Sasso and Indigenous breeds.

When the homemade least-cost ration inclusion increases, the fiber content of the ration was increased from 4% to 10% as presented in Table 3. Due to this reason, the feed intake of the chicken decreased as the homemade least-cost ration increased.

Table 3. Chemical composition of the experimental ration

Chemical analysis of the ration					
Nutrients	**T1**	**T2**	**T3**	**T4**	**T5**
DM %	94.2	94	93.6	92	91
CP% DM bases	20.9	20.3	19	18.7	18
CF% DM bases	4	4.5	6.4	8.5	10
EE% DM bases	3	3.8	5.4	5.8	6
ME kcal/kg	3035	3000	2975	2890	2875

T1=0% least-cost diet; T2=25% least-cost diet; T3=50% least cost diet; T4=75% least cost diet and T5=100% least cost diet

Table 4. The mean feed consumption and mean body weight gain of Sasso and Indigenous chicks during the first 4 weeks

Parameters	Sasso T-44					Indigenous local ecotypes					*p*-value
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	
Daily intake at 1st 4 weeks (g)	20.4[a]	19.7[a]	21.0[a]	29.1[a]	22.7[a]	10.3[a]	8.6[a]	8.1[a]	7.4[a]	6.6[b]	0.05
Weekly intake at 1st 4 weeks (g)	143.4[a]	138.1[a]	147.6[a]	204.1[a]	158.9[a]	72.3[a]	60.2[a]	56.7[a]	52.4[a]	46.8[b]	0.05
Total intake at 1st 4 weeks (g)	17718.0[a]	18937.1[a]	19115.9[a]	28607.2[a]	21655.9[a]	1440.5[b]	1549.5[b]	1275.0[b]	1322[b]	1070.0[b]	<0.001
Mean initial weight (g)	56.5[a]	53.3[a]	48.8[a]	56.8[a]	50.0[a]	26.2[b]	26.6[b]	24.3[b]	25.5[b]	25.8[b]	<0.001
Mean final weight at 4th weeks (g)	228.5[a]	232.6[a]	172.6[a]	181.1[a]	108.1[b]	51.5[b]	51.7[b]	52.5[b]	55.1[b]	51.4[b]	<0.001
Mean daily gain 1st 4 weeks (g)	3.9[a]	4.1[a]	3.3[a]	3.3[a]	2.4[b]	1.2[c]	1.2[c]	1.2[c]	1.5[c]	1.2[c]	<0.001
Mean weekly gain 1st 4 weeks (g)	29.9[a]	30.9[a]	24.8[a]	24.8[a]	18.2[b]	9.6[c]	9.4[c]	9.4[c]	11.5[c]	9.4[c]	<0.001
Mean total gain at 1st 4 weeks (g)	3441.6[a]	3964.8[a]	2999.0[a]	3291.4[a]	2337.9[b]	184.4[c]	227.8[c]	201.6[c]	272.0[c]	203.7[c]	<0.001
Mean FCR at 1st 4 wks	1.2	1.2	1.5	2.9	2.0	2.8	3.0	3.0	3.0	3.0	0.65

FCR=feed conversion ratio; T1=0% least-cost diet; T2=25% least-cost diet; T3=50% least-cost diet; T4=75% least-cost diet and T5=100% least-cost diet; Similar letters are indicated no significant difference

Table 5. The mean feed consumption and mean body weight gain of Sasso and Indigenous chicks during 5-8 weeks

Parameters	Sasso T-44					Indigenous local ecotypes					*p*-value
	T1	T2	T3	T4	T5	T1	T2	T3	T4	T5	
Daily intake 5-8 weeks g/head	43.8[a]	42.4[a]	42.3[a]	43.0[a]	42.2[a]	18.7[b]	21.1[b]	18.8[b]	18.7[b]	19.7[b]	<0.001
Weekly intake 5-8 weeks (g/head)	306.9[a]	296.9[a]	296.5[a]	301.0[a]	295.7[a]	130.9[b]	147.9[b]	132.0[b]	130.9[b]	138.5[b]	<0.001
Total intake 5-8 weeks g/head)	36502.1[a]	39428.9[a]	36463.5[a]	41483.7[a]	33547.2[a]	1899.2[b]	2769.6[b]	2317.5[b]	2208.5[b]	2591.4[b]	<0.001
Mean initial weight on 5th week (g)	319.7[a]	319.7[a]	280.0[a]	280.6[a]	114.9[b]	63.6[b]	62.7[b]	62.4[b]	68.7[b]	59.6[b]	<0.001
Mean final weight on 8th week (g)	708.7[a]	590.0[a]	518.0[a]	484.0[a]	172.6[b]	115.6[b]	104.2[b]	104.4[b]	118.1[b]	77.1[b]	<0.001
Mean daily gain 5-8 weeks (g/head)	17.2[a]	13.9[a]	13.0[b]	12.6[b]	4.9[c]	3.0[c]	2.8[c]	2.8[c]	3.1[c]	2.2[c]	<0.001
Mean weekly gain 5-8 weeks (g/head)	129.5[a]	104.4[a]	98.1[b]	94.6[b]	37.3[c]	22.5[c]	21.0[c]	21.2[c]	23.5[c]	17.0[c]	<0.001
Total Mean gain 5-8 weeks (g/head)	14263.8[a]	13061.8[a]	12206.0[b]	10758.5[b]	3977.2[c]	305.8[d]	385.9[d]	337.9[d]	375.0[d]	294.5[d]	<0.001
Mean FCR 5-8 weeks	0.6[a]	0.7[a]	0.8[a]	0.8[a]	2.1[b]	1.9[b]	2.4[c]	2.2[b]	2.0[b]	2.9[d]	<0.001

FCR= feed conversion ratio; T1=0% least-cost diet; T2=25% least-cost diet; T3=50% least-cost diet; T4=75% least-cost diet and T5=100% least-cost diet; Similar letters are indicated no significant difference

Table 6. Mean feed consumption and body weight gain of Indigenous chicks during 9-24 weeks

Parameters	Indigenous breed					*p*-value
	T1	T2	T3	T4	T5	
Daily intake, 9-24 weeks (g)	50.1^{a}	41.9^{b}	38.4^{b}	41.8^{b}	33.9^{c}	<0.001
Weekly intake,9-24 weeks g)	1403.4^{a}	1175.2^{b}	1075.8^{b}	1172.9^{b}	951.0^{c}	<0.001
Total intake, 9-24 weeks (g)	18043.9^{a}	15110.0^{a}	14058.6^{b}	15080.8^{b}	12344.2^{c}	<0.001
Mean initial weight 9th Week (g)	131.3^{a}	115.1^{a}	116.1^{a}	128.4^{a}	87.1^{b}	<0.001
Mean final weight 24th Week (g)	733.6^{a}	635.3^{b}	595.0^{c}	525.3^{d}	446.5^{e}	<0.001
Daily gain 9-24 weeks (g)	3.3^{a}	2.5^{b}	2.5^{b}	2.4^{b}	1.9^{c}	<0.001
Weekly gain 9-24 weeks (g)	24.8^{a}	19.3^{b}	19.2^{bc}	18.4^{c}	14.6^{d}	<0.001
Total gain 9-24weeks (g)	1191.3^{a}	928.3^{b}	928.6^{b}	885.4^{c}	709.0^{d}	<0.001
Mean FCR 9-24 weeks	3.4^{c}	4.13^{b}	4.5^{b}	4.7^{b}	5.7^{a}	<0.001

FCR=feed conversion ratio; T1=0% least-cost diet; T2=25% least-cost diet; T3=50% least-cost diet; T4=75% least-cost diet and T5=100% least-cost diet; Similar letters are indicated no significant difference

"The current finding of daily feed consumption (MDFC) contradicts earlier reports [19] but agrees with the total feed intake of the chicken. The total feed intake of the current study was similar to the report of" [20]. Since, the MDFC of the current study was low as [21] reported this may be due to different altitudes, feed ingredients and breeds, used for the experiments. "The feed intake of the chicken was decreased due to fibrous and bulky nature of the homemade least-cost ration may be attributed to couples with the low nutrient (energy) content" [22,23]. "High dietary fiber is recognized to limit the amount of energy available to chickens and equally contributes to excessive nutrient excretion" [24]. "Unfortunately, it seems to disagree with the report [25] that feed consumption and the quantity of feed required per kg of gain increased with an increase in dietary fiber".

3.3 Growth Performance

The growth performance of the experimental chick's results is presented in Tables 4-6. The overall mean initial body weight of Indigenous and Sasso T-44 day-old chicks was 26 and 53g/h, respectively, which indicates that the mean hatching weight of the Indigenous experimental chicks was 49.1% of that of Sasso T-44. The mean daily, weekly and total body weight gain was not significantly different (P>0.05) between the indigenous treatment groups during the first 4 weeks of the brooding period. However, the mean daily, weekly and total body weight gain of Sasso chicks assigned to homemade starter's ration was significantly (P<0.001) lower than the starters ration containing 25, 50, 75, and 100% commercial starter's rations. These rations attained bodyweight of 118.1, 172.6, 232.6, and 228.5g/h at an age of 4 weeks, respectively but no significant difference (P>0.05) among the treatments. The Sasso groups assigned to homemade starter's ration reached a mean body weight of 108.1g/h at an age of 4 weeks. This value was about 47% of that of the Sasso breed groups assigned to commercial starters ration at the same age. The Sasso treatment group attained an overall mean of 185g/h but Indigenous treatment groups attained an overall mean of 52.4g/h at an age of 4 weeks. This value was 28% of that of the overall mean of the Sasso treatment groups at an age of 4 weeks.

During the second 4 weeks of the brooding period, the mean daily, weekly and total body weight gain, and mean final body weight were not significantly different (P>0.05) between the Sasso groups fed on homemade starter's ration and the indigenous groups fed on the starter's rations containing 25, 50, 75, and 100% commercial starter's rations. However, the mean final body weight of the Sasso groups fed on homemade starters ration was significantly (P<0.05) lower than that of the other Sasso treatment groups at an age of 8 weeks.

"The mean daily body weight gain in the current study was similar to the [19-21,24,26] report, but opposed to the MFBW finding on Bovan Brawn chicken performance under the backyard chicken management system". "The chicken growth performance under 75 and 100% of the least-cost homemade starter's ration was depressed due to high fiber content and low nutritive value" [27-29]. "In the current study result, the MWBWG of the Sasso breed was higher [30] but the Indigenous was a lower observation on Botswana chicken fed the commercial ration for 18 weeks". "In the present study, similar findings of the growth rate of the experimental chicks were progressive increment with the advancement of age within the Sasso breed and indigenous breeds" [20]. "The MFBW and MDBWG of Indigenous breed under an intensive production system [21] were lower than in the current study. However, MFBW was lower than the report of [13] on broiler growth performance evaluation in the same manner".

3.4 Feed Conversion Ratio

The feed conversion ratio of chicken means the rate measuring of efficiency with bodies of the birds converts the feed into the desired output. In the present study, as indicated in Tables 4-6, the mean feed conversion ratio of the experimental chicks was not significantly different (P>0.05) between the Sasso breed and Indigenous chicks during the first 4 weeks of the brooding period. Yet, the mean feed conversion ratio of the Sasso groups assigned to homemade starter's ration was significantly lower (P<0.05) than that of the other Sasso treatment groups during (5-8) weeks. The mean feed conversion ratio in Indigenous groups fed on 100% commercial starter's ration was significantly (P<0.001) higher than the Indigenous groups fed on the other starter's ration during the rearing period of 9-24 weeks.

According to a [19-21,14] report, the feed conversion ratio of the chicken range from 0.6 to 2.9 for exotic and indigenous breeds. In the current study also the feed conversion ratio had a similar observation under the similar chicken production system.

3.5 Economic Feasibility of Homemade Least-cost Ration

The relative economic feasibility of homemade least-cost and commercial starter's rations on Sasso and Indigenous chicken growth performance is presented in Tables 7 and 8. The market price of the commercial starter's ration was greater than the price of the homemade starter's ration, according to the findings. Sasso breed fed on the treatment rations containing 50, 75, and 100% commercial starter's rations were highly (P<0.001) profitable as compared to the Sasso groups fed ration containing 0 and 25% commercial starter's rations. The net return of Indigenous breed under all treatment groups was not profitable and this might be attributed to the occurrence of high mortality or death. In general, in the present study, Indigenous breed kept under an intensive/confined/ production system was not profitable.

The results of the current study was similar observation with different previous studies reported by [21,22,23]. Indigenous chickens are considered to be disease resistant and adapted to their scavenging environmental conditions [10]. Unfortunately, indigenous chickens was characterized by a lack of interest under intensive system of management (in confinement) environment and wing droppings, huddling at the corner, leg weakness and cannibalism are inferior to exotic stock in health status. "They are also slow in rate of feathering and exhibit recurrent outbreaks of disease" [21].

Indigenous chickens under the intensive management system had high mortality was not clear, but it could be because they are not used to confinement. Diseases such as coccidiosis have a more significant effect on indigenous chicks than on exotic chicks under confinement [5]. Indigenous chickens are appropriate under the traditional production system with minimal input levels that make the best use of locally available resources, according to the findings of this study. The general consensus is that this condition necessitates scientific investigation and explanation.

"Reduction in feed cost per kg weight gain of chicks fed commercial ration had similar to be reported" [23,31]. The decrease in feed cost per kg weight gain observed in chicks fed the commercial ration could be attributed to an increase in average daily feed intake (ADFI), higher feed efficiency and utilization, and enhanced chick average daily weight gain (ADWG).

Table 7. Mean Economic feasibility of homemade least-cost ration for each treatment

Parameters cost/Eth.br/	Treatments					Mean	p-value
	T1	T2	T3	T4	T5		
Chick's market price	1079^{a}	1079^{a}	1079^{a}	1079^{a}	1079^{a}	1079	-
Commercial feed cost	758^{a}	638^{a}	390^{b}	220^{b}	0^{c}	401	0.001
Homemade feed cost	0^{d}	156^{c}	287^{b}	486^{a}	534^{a}	293	0.001
Total feed cost	758	795	678	706	534	694	0.1301
Total variable cost	1837	1874	1757	1785	1614	1773	0.1301
Gross income	3238^{a}	3516^{a}	2600^{ab}	2643^{ab}	1373^{b}	2674	0.0057
Total return	2159^{a}	2437^{a}	1520^{ab}	1564^{ab}	294^{b}	1595	0.0057
Net return	322^{a}	563^{a}	-237^{b}	-221^{b}	-1319^{c}	-178	0.0027

T1=0% least-cost diet; T2=25% least-cost diet; T3=50% least cost diet; T4=75% least cost diet and T5=100% least cost diet; Similar letters are indicated no significant difference

Table 8. Economic feasibility of homemade least-cost ratio for Sasso and Indigenous chicks in each treatment

Parameter cost/Eth.br/	**Breeds**										**Mean**	***p*-value**
	Sasso T-44 breed					**Indigenous breed**						
	T1	**T2**	**T3**	**T4**	**T5**	**T1**	**T2**	**T3**	**T4**	**T5**		
Chick's cost	929.0^{a}	929.0^{a}	929.0^{a}	929.0^{a}	929.0^{a}	150.0^{b}	150.0^{b}	150.0^{b}	150.0^{b}	150.0^{b}	539.5	0.001
Feed cost	354.8^{a}	358.9^{a}	311.2^{a}	322.2^{a}	245.6^{a}	24.5^{b}	38.7^{b}	28.1^{b}	31.2^{b}	21.9^{b}	173.7	0.002
Total variable cost	1283.8^{a}	1288.0^{a}	1240.2^{a}	1251.2^{a}	1174.5^{a}	174.5^{b}	188.6^{b}	178.1^{b}	181.2^{b}	171.9^{b}	713.2	0.001
Gross income cost	3043.3^{a}	3336.6^{a}	2460^{ab}	2213^{ab}	1283.3^{b}	151.6^{c}	180.0^{c}	113.3^{c}	110.0^{c}	90.0^{c}	1298	0.001
Total return	2114.3^{a}	2407.6^{a}	1531^{ab}	1284^{b}	354.3^{c}	1.6^{d}	30^{d}	-36.7^{d}	-40^{d}	- 60^{d}	758.6	0.001
Net return	830.5^{a}	1119.6^{a}	290.8^{b}	33^{c}	-820.2^{d}	-173^{d}	-159^{d}	-215^{c}	-221^{c}	-231.9^{c}	45.4	0.003

T1=0% least-cost diet; T2=25% least-cost diet; T3=50% least cost diet; T4=75% least cost diet and T5=100% least cost diet; Similar letters are indicated no significant difference

4. CONCLUSION

It is concluded that homemade low-cost rations can be used up to 50% in the commercial Sasso starter ration without impacting chick growth or reducing the cost of feed eaten per kg of chicken weight gain.

ETHICS STATEMENTS APPROVAL

The experimental procedure was reviewed and approved by Debre Tabor University Research Ethics Committee (Ref. No. DTU10/20) and it was conducted by qualified and experienced personnel under the supervision of a veterinarian, according to the guidelines of the World Organization for Animal Health.

DISCLAIMER

The products used for this research are commonly and predominantly used products in our area of research and country. There is no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by the personal efforts of the authors.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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