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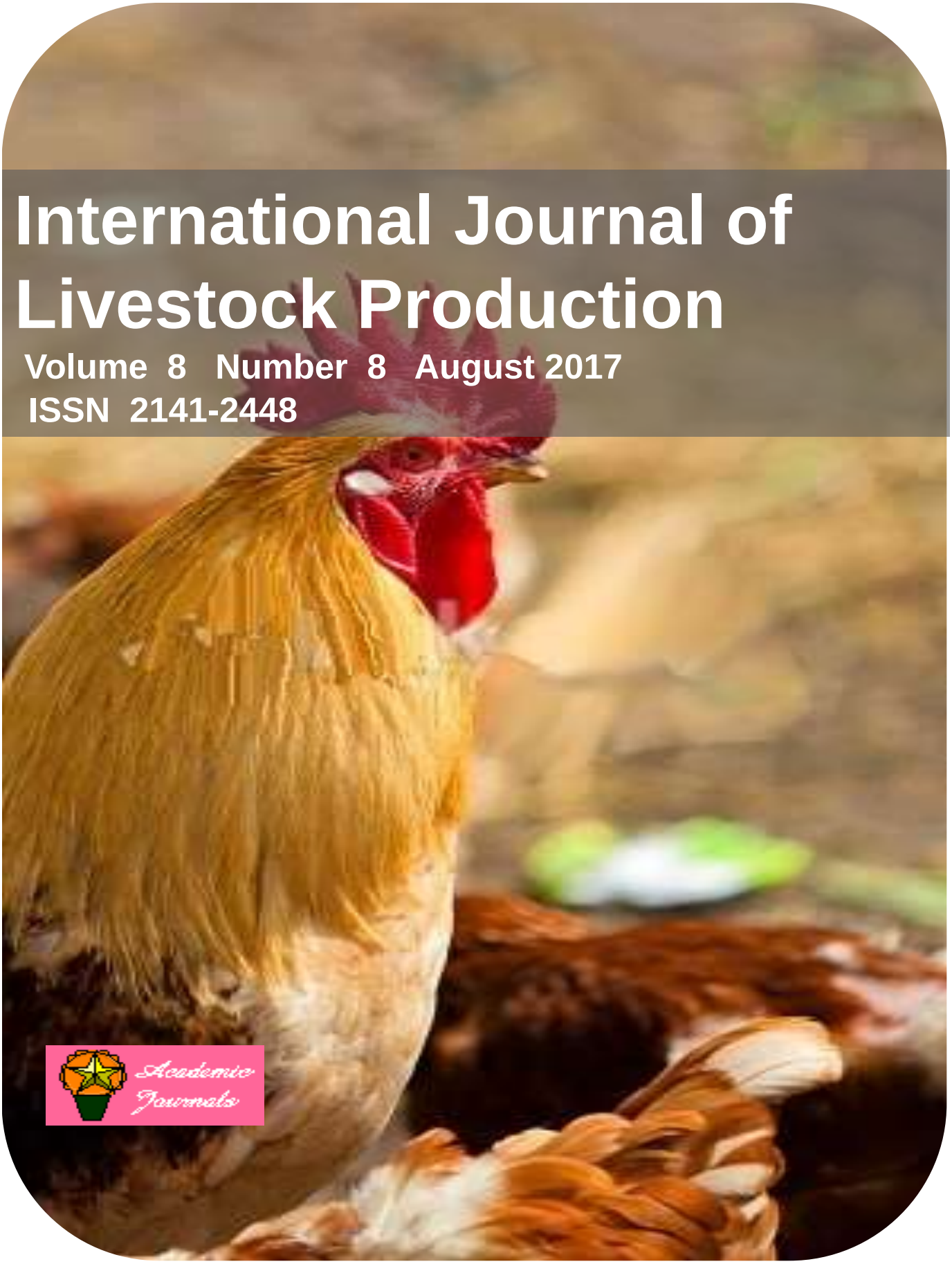

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Full Length Research Paper

The effect of limiting feeding time by three and six hours per day during the starter period on broiler performance

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In a completely randomized design, one hundred and twenty one- day old (Arbor acres) broiler chicks were randomly distributed in three treatments, five replicates with eight chicks per a replicate. The treatments were: 24 h *ad libitum* feeding (A), B feed removal from 9:00 to 12:00 noon (3 fasting hours) and C feed removal from 9:00 to 3:00 pm (6 fasting hours). Feed restriction was applied from 8 to 28 days of age. The experiment lasted from 8 to 37 days of age. The results showed that fasting birds for three and six hours had significantly ($p<0.05$) no effect on body weight, weight gain, feed intake and feed conversion ratio at 37 days of age.

Key words: Broilers; feed removal; starter period; performance.

INTRODUCTION

Broiler nutrition have been subjected to different types of experiments in order to reach acceptable market weight without any adverse effects that might cause failure of the birds to show their maximum growth rate**.** Researchers examined different feed ingredients, feed additives, feed qualities and examined different feeding programs attempting to find the most suitable feed or feeding program for the fast growing strains. Although *ad libitum* feeding is necessary for fast growing broiler chickens to meet their maximum growth potential, it has led to more frequent occurrences of metabolic and skeletal disorders and increased fat deposition (Yu and Robinson, 1992). Feed restriction programs are applied to reduce the negative effects of fast growth rate. These programs rely on the phenomenon called compensatory growth. Restricted feeding programs may result in synchronizing the speed of growth of different body organs and decreases bad effects of rapid growth (Balog et al., 2000), and it is expected that when feed restriction is over, feed intake would increase consequently; growth

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performance would increase and declines maintenance energy. Various quantitative and qualitative methods of feed restriction are used in broilers to improve their efficiency of feed utilization and weight gain (Mahmood et al., 2007). Such methods result in temporary reduction of growth rate, while the normal weight of broilers can be attained on removal of feed restriction, thus improving the feed efficiency and decreasing the feeding cost (Mahmood et al., 2007; Sahraei, 2012). The objective of the present study was to evaluate the effect of limiting feeding time by three and six hours during the starter period on broiler chicks` performance.

MATERIALS AND METHODS

One hundred and twenty one-day old chicks (Arbor acres) were reared in a group for one week (adaptation period). At day 8 of their age, these chicks were randomly divided into 15 experimental units of 8 chicks each. These units were further allotted randomly to three treatment groups A, B and C such that each treatment received five replicates. The chicks in group A were fed ad libitum and served as control. The chicks in groups B and C were kept on a feed restriction program**.** The weights of the birds in the replicate groups were adjusted to give near uniform initial weights for all the groups. The experiment lasted from 8 to 37 days of age. The experiment was carried out at the Animal Production Research Center, Khartoum North, Sudan, during February to March 2015. Mean monthly temperatures were 28.3 and 31.1ºC.

Restriction program

A= 24 h *ad libitum* feeding, B = 3 h feed removal from 9:00 to 12:00 noon (3 fasting hours) and C= 6 h feed removal from 9:00 to 3:00 pm. (6 fasting hours).Restriction program was applied from 8 to 28 days of age.

Experimental diets

All birds received the same pre-starter diet to 7-days of age, the same starter diet to 28 days old and the same finisher diet to 37 days old (Table 1). All diets were formulated to meet the nutrient requirements according to NRC (1994).

Housing

The birds were maintained in a thoroughly cleaned and disinfected open- sided poultry house. Each replicate was kept in a separate pen measuring 1 × 1 m^2 during the experimental period. Saw dust was used as litter material. The birds were kept under similar managemental conditions like space, feed, and vaccination program up to the age of six weeks. Fresh and clean water was available ad libitum during the experimental period.

Data collection

The data collected during the experiment included weekly body weight, feed intake, weight gain, feed conversion ratio and final body weight. The data was collected in group basis. At day 37 of age, after feed withheld for 12 h; ten birds from each treatment were randomly selected for carcass and carcass cuts weight.

Statistical analysis

In this experiment birds were assigned to the three dietary treatment groups following a completely randomized design (CRD). The experimental units were replicate cage means. All data were analyzed using the One-Way ANOVA procedure for analysis of variance. Significant differences among treatments were identified at $p<0.05$ level by Duncan's multiple range test (1955).

RESULTS

Effect of limiting feeding time by 3 and 6 h per day during the starter period on body weight and weight gain

The results of limiting feeding time by 3 and 6 hours per day on body weight and weight gain are presented in Table 2. At 14 days of age, control and six hours fasted birds showed significantly ($p<0.05$) the same body weight and weight gain. The difference in performance between control birds and three hours fasted birds was significant. Comparing restricted birds, the difference in performance was not significant. During the next weeks, limiting feeding time by three and six hours had no effect on body weight and weight gain.

Effect of limiting feeding time by 3 and 6 h per day during the starter period on feed intake and feed conversion ratio

The results of limiting feeding time by 3 and 6 h per day on feed intake and feed conversion ratio are presented in Table 3. At 14 days of age, control and six hours fasted birds consumed significantly ($p<0.05$) the same amount of feed and had the same feed conversion ratio. The differences between control birds and three hours fasted birds were significant. Comparing restricted birds, the differences were not significant. During the next weeks, limiting feeding time by three and six hours had no effect on feed intake and feed conversion ratio.

Effect of limiting feeding time by 3 and 6 h per day during the starter period on carcass weight

The results of limiting of feeding time by 3 and 6 h per day during the starter period on carcass and carcass cuts weigh are presented in Table 4. The results showed no significant differences ($p<0.05$) in whole carcass and cuts weights between control and the fasted groups. Despite that, six hours fasted birds gained the highest weight for whole carcass and carcass cuts.

Effect of limiting feeding time by 3 and 6 h per day during the starter period on overall performance

The results of limiting of feeding time by 3 and 6 h per

Table 1. Composition and calculated nutrients of the experimental diets (%).

Ingredients	Starter	Finisher
Sorghum	67.5	68.7
Groundnut cake	25	22
*Super concentrate	5	5
Lime stone	1.7	1.5
Methionine	0.15	0.15
Lysine	0.2	Not added
Anti mycotoxin	0.2	0.1
Tallow	0	2.3
Salt	0.25	0.25
Total	100	100
Calculated nutrients		
ME (kcal/kg)	2951	3112
Crude protein (%)	23	21.15
Crude fiber (%)	4.4	4.01
Methionine (%)	0.55	0.59
Lysine (%)	1.27	1.01
Ca (%)	1.34	1.10
Available phosphorus (%)	0.55	0.53

*Composition of the super concentrate: ME = 1900 kcal/ kg, CP = 35%, EE = 2.5%, CF = 3.0%, Ca = 6.5, P = 6.5, Lysine =11.0, Methionine = 4.2.

Table 2. Effect of limiting feeding time by 3 and 6 h/day during the starter period on body weight and weight gain (g).

Parameter	Treatments		
	A	B	C
Body weight (g/b)			
Bird age (days)			
8- 14	343.38±13.55^{a}	318.28±20.2^{b}	326.75±12.4^{ab}
15- 21	621.01±18.99^{a}	605.00±23.39^{a}	605.5±15.47^{a}
22- 28	1028.95±37.61^{a}	1010.4±53.96^{a}	996.2±37.88^{a}
29- 37	1478.86±127.5^{a}	1362.96±219.29^{a}	1410.53±194.18^{a}
Weight gain (g/b)			
Bird age (days)			
8- 14	216.68±12.86^{a}	191.6±19.83^{b}	200.2±12.34^{ab}
15- 21	278.4±6.54^{a}	246.8±89.38^{a}	229.6±86.72^{a}
22- 28	407.6±20.86^{a}	405.6±53.44^{a}	388.6±23.62^{a}
29- 37	450.23±97.32^{a}	437.74±68.72^{a}	496.71±30.4^{a}

Means within a raw with different super scripts differ significantly ($p<0.05$); Values are means ± standard deviation.

day during the starter period on overall performance are presented in Table 5. The results showed no significant differences ($p<0.05$) in overall performance between control, 3 and 6 h fasted birds. The highest body weight, weight gain and better feed conversion ratio were showed by control bird. Six hours fasted birds showed more body weight, weight gain than 3 h fasted birds. Three hours fasted birds consumed more feed than the other two groups and showed the poorest feed conversion ratio.

DISCUSSION

Performance at 14 days old

Control birds showed significantly ($p<0.05$) heavier body weight than the other restricted groups (Table 2).

Table 3. Effect of limiting feeding time by 3 and 6 h/day during the starter period on feed intake and feed conversion ratio (g).

Parameter	Treatment		
	A	B	C
Feed intake (g/b)			
Bird age (days)			
8-14	293.36±21.85[a]	255.2±22.07[b]	274.4±8.47[ab]
15- 21	322.43±32.81[a]	325.6±19.28[a]	314.6±21.04[a]
22- 28	811.6±37.38[a]	796.6±18.34[a]	784.28±31.51[a]
29- 37	968.27±145.27[a]	774.91±394.96[a]	937.19±66.37[a]
***FCR(g feed: g weight gain)**			
Bird age (days)			
8-14	1.36±0.11[a]	1.33±0.04[a]	1.38±0.08[a]
15- 21	1.16±0.12[a]	1.14±0.11[a]	1.17±0.11[a]
22- 28	1.99±0.05[a]	2.0±0.28[a]	2.0±0.12[a]
29-37	2.21±0.38[a]	2.14±0.31[a]	1.94±0.05[a]

Means within a raw with different super scripts differ significantly ($p<0.05$); *FCR = feed conversion ratio (gram feed intake/gram weight gain); Values are means ± Standard deviation.

Table 4. Effect of limiting feeding time by 3 and 6/day on carcass weight (g).

Treatment (h)	Carcass	Breast	Thigh	Drumstick	Wings
Control	963.44±96.94[a]	312.00±56.41[a]	206.00±33.80[a]	135.00±16.58[a]	121.0±15.17[a]
3	1061.0±21.98[a]	321.00±36.98[a]	209.20±18.79[a]	144.00±16.73[a]	123.0±12.55[a]
6	1024.0±98.34[a]	323.00±47.64[a]	224.00±34.35[a]	146.00±18.17[a]	128.0±12.04[a]

Means within a column with the same super scripts do not differ significantly ($p<0.05$); Values are means ± Standard deviation.

Table 5. Effect of limiting feeding time by 3 and 6 h/day on overall performance (g).

Treatment (h)	Body weight	Weight gain	Feed intake	*FCR
Control	1478.80±127.41[a]	1353.10±127.02[a]	2378.38±178.37[a]	1.762±0.06[a]
3	1363.00±219.42[a]	1308.72±98.94[a]	2438.33±60.88[a]	1.892±0.17[a]
6	1410.40±194.07[a]	1345.86±56.64[a]	2390.56±127.97[a]	1.788±0.09[a]

Means within a column with the same super scripts do not differ significantly ($p<0.05$); *FCR = feed conversion ratio (gram feed intake/gram weight gain); Values are means ± standard deviation.

This result agrees with Mahmood et al. (2007) and Acheampong-Boateng et al. (2012). Decreased body weight of restricted groups was due to feed removal (Zubair and Leeson, 1996; McGovern et al., 1999). Different results were observed by Saleh et al. (1996) who reported no effect of feed removal on body weight. The results showed that restricted birds gained less weight than control ones (Table 2). This result is in accordance with those of Acheampong-Boateng et al. (2012) and is not in accordance with those of Lee and Leeson (2001) who reported higher weight gain in restricted birds than those fed *ad libitum.* Zhong et al. (1995), and Zubair and Leeson (1996) reported different results. They found similar weight gain in restricted and control birds. The probable explanation of the lower body weight and weight gained is the reduced feeding time of restricted birds. Control birds consumed more feed than restricted birds (Table 3). The result of this study follows those of Mahmood et al. (2005, 2007) and Acheampong-Boateng et al. (2012) who found that restricted birds consumed lesser quantities of feed. According to the present study, fasting for 3 and 6 h had no effect on feed conversion ratio at 14 days old (Table 3). Control and restricted birds showed significantly the same feed conversion ratio. This result does not follow what was reported by Deaton (1995), Zhong et al. (1995), Lee and Leeson (2001) and Mahmood et al. (2007). They observed better conversion values in birds kept under

restricted feeding compared to *ad libitum* fed birds. It seemed that fasting broilers do not affect their ability the utilize nutrients at 14 days of age.

Performance at 21 to 37 days old

At this age, restriction regime applied in the present study had no effect on body weight, weight gain (Table 2), feed intake and feed conversion ratio (Table 3) of full fed and restricted birds. The insignificant differences in weight gain were supported by the findings of Netshipale et al. (2012), and disagree with De Silva and Kalubowila (2012) and Netshipale et al. (2012) who found body weight reduction with increased limiting of feeding time at this age. This result agrees with De Silva and Kalubowila (2012) and Netshipale et al. (2012) who observed the same feed intake of restricted birds. The results of feed intake in this study do not agree with Novel et al. (2009) and Boostani et al. (2010) who reported reduced feed intake of restricted birds. The insignificant differences in feed conversion ratio of control, 3 and 6 h restricted group follow the findings of Dozier et al. (2002) and Khajali et al. (2007). This result in feed conversion ratio due to feed restriction does not agree with the findings of Lee and Leeson (2001), Dozier et al. (2003), Navidshad et al. (2006), and Mahmood et al. (2007). They observed better conversion values in birds kept under restricted feeding compared to ad libitum fed birds and do not follow the findings of Balog et al. (2000), Camacho et al. (2004) and Boostani et al. (2010) who reported reduced body weight and feed intake of 8 h/ day restricted birds. Aziz (2012) also found that weight gain, feed intake and feed conversion ration of restricted birds were lower than those of control ones. Different results were reported by Mehmood et al. (2013) who found that the maximum feed intake was recorded in *ad-libitum* and 3 h fed birds than those of 1 or 2 h access to feed. This could be attributed to ample time available with full-fed and 3 h feeding as compared to limited access birds which could have resulted in higher feed consumption. Similarly, Mahmood et al. (2007) also reported significantly higher feed intake in full fed birds as compared to restricted ones.

Carcass weight

The feed restriction procedure applied in this study showed no significantly differences in whole carcass and cuts between restricted and *ad libitum* fed birds (Table 4). Despite that restricted birds had higher carcass and cuts weights than the *ad libitum* fed birds. Six hours fasted birds were the best, which may be a preferred restriction method for whole carcass and cuts production. More studies should be conducted to affirm this suggestion. The insignificant differences in whole carcass and carcass cuts weights between the control and fasted birds follow the findings of Camacho et al. (2004), and Mohebodini et al. (2009) who found no significant differences in carcass weight and thigh weight between restricted and control birds and do not follow the findings of Mohebodini et al. (2009) who found significantly lower carcass weight breast weight compared to that of control birds. The results also do not follow the findings of Boostani et al. (2010) who found significantly lower carcass weight and breast weight as compared to those of control birds.

Overall performance

The results obtained in this study showed no significant differences ($p<0.05$) in overall performance between control, 3 and 6 h fasted birds (Table 5). The insignificant differences in overall performance between the control and fasted birds follow the findings of De Silva and Kalubowila (2012) who found no significant differences in feed intake between control and 3 h restricted birds. The results of the overall performance also agree with the findings of Urdaneta-Ricon and Lesson (2002), Dozier et al. (2002, 2003), and Khajali et al. (2007) who stated that broiler chickens are able to compensate for loss of weight resulting from short periods of feed restriction at early age, and do not follow the findings of De Silva and Kalubowila (2012) who found significant reduction in body weight at 42 days old after 3 h fasting per day from 21 to 42 days old. The in significant differences in overall performance between the control and fasted birds is supported by the findings of Navidshad et al. (2006), Mohebodini et al. (2009) and Benyi et al. (2011). Acheampong-Boateng et al. (2012) found that feed restriction birds could not recover from the slow growth during restriction and they were lighter than the control group. Netshipale et al. (2012) also found that reducing feeding time do not allow complete compensatory growth at 49 days old, while Boostani et al. (2010) found that 8 h feed removal during the day allow complete compensatory growth at 42 days old. David and Subalini (2015) also found that the growth performance and carcass characteristics of broiler chickens were not affected by feed restriction for 3, 5 and 7 h**.** The feed removal for 3 and 6 h used in this study showed good but not complete compensatory growth at 37 days old.

Conclusion

In this study birds whose feeding time was reduced by 3 or 6 h from 9:00 to 12:00 noon and 9:00 to 3:00 pm between 8 and 28 days of age were able to compensate for the loss of weight incurred during the period of feed restriction and have statistically the same body weight as their counterparts which were fed *ad libitum* throughout this study. It could be concluded that, restricted broiler

chicken compensate the weight lost during 20 days of feed removal for 3 and 6 h/day in 9 days re-feeding time.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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Full Length Research Paper

Participatory identification of breeding objective traits of Woyto-Guji goat in Loma district, Southern Ethiopia

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Woyto-Guji goat breeds suitable for diverse purposes in the different production environments or ecological zones in the district. Farmers in different production systems have different trait preferences and the strategies followed by them are also as diverse as the agro-environments within which they operate. Socio-economic (cash, asset, security) and production or yield attribute (meat) were ranked first and second preferred traits by farmers with index of 0.47, 0.44 in lowland; 0.45, 0.42 in midland and 0.47, 0.40 in highland areas. that body conformation, adaptation, twining ability, coat color, ranked as first to fourth traits with index value of 0.22, 0.18, 0.16, and 0.15, respectively, by farmers for selection of females. In order to design a viable breeding plan, farmers' preferences for the different traits need to be investigated. Participatory definition of trait preferences was undertaken to pave the way for deriving economic weights of traits to develop selection indices.

Key words: Goat breeding, purpose, traits preference.

INTRODUCTION

Ethiopia is home for diverse indigenous goat populations, numbering 22.78 million heads (CSA, 2011) and 15 breeds of goat (IBC, 2004) that have traditionally been an integral part of the farming systems in all agro-climatic conditions. It has been estimated that about 70% of the goat population is found in the low lands and the rest 30% is found in the high lands (Alemayehu, 1993). Goat and sheep account for about 90% of meat and 92% of skin and hide (Adane and Girma, 2008) export trade value in Ethiopia. Moreover, goats play an important role in the livelihood of resource-poor farmers and they provide a vast range of products and services such as meat, milk, cash income, skin, manure and security (insurance), banking, gifts, etc. (Adane and Girma, 2008). Currently, the role of goats in improving the income and livelihood of rural people in the region is gaining importance (Feki, 2013).

They overlooked the significance of livestock in the tropics, which transcends economic considerations and enters the social, cultural and ritual realm (FAO, 2009). Community based breeding programs have now emerged as promising approach in the tropics where-in farmers actively participate from the designs to the implementation of breeding programs. However, sustainability of such programs would depend on producer's interest which could also be influenced by socio-cultural, economic and geographical factors (Ilatsia et al., 2012). An understanding of producer's trait or breed preferences and selection criteria would enable breeders in the regions to effectively design sustainable

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Table 1. Purpose of keeping goats and their relative importance as ranked by households (HH).

Objectives	Lowland				Midland				Highland				Overall			
	R1	R2	R3	I	R1	R2	R3	I	R1	R2	R3	I	R1	R2	R3	I
Socio economic	53.3	44.4	33.3	0.47	51.4	42.8	28.6	0.45	52.8	42.8	37.1	0.47	52.5	43.3	33	0.46
Production	44.4	46.6	40.0	0.44	42.8	40.0	45.7	0.42	42.8	34.3	40.0	0.40	43.2	40.3	42	0.42
Socio-cultural	3.2	8.8	26.6	0.09	5.7	17.1	25.7	0.12	4.3	22.8	22.8	0.13	4.3	16.23	25	0.12

genetic improvement programs that would make possible to develop and promote appropriate goat genotypes that match with the prevailing socio-economic and cultural environments (Gwaze et al., 2009; Bett et al., 2011). More importantly, an understanding of selection criteria of goat keepers would provide information for deciding how to approach small ruminant herders in order to establish community-based breeding programs (Mbuku et al., 2006). This study was therefore, undertaken to explore the purpose of goat keeping, breed preferences and selection criteria used by goat owner households in Loma district.

MATERIALS AND METHODS

Descriptions of the study area

The study was conducted in Loma district, located at 6°55′N and 7°01′30″N latitude, and 37°15′ E and 37°19′E longitude with at altitudinal range between 501 to 3300 masl. Loma is one of the administrative districts under Dawuro Zone of Southern Nations, Nationalities and Peoples Region (SNNPRS-BoFED, 2004; Mathewos, 2008). The total surface area is 145,320 km^2, with average density of 13 persons per km^2 making the district one of the sparsely populated in lowland region. The Agro – Ecology of the district comprise of 45.6% lowland (less than 1500 masl), 41.4% midland (between 1500 to 2300 masl) and 13% highland (greater than 2300) out of the total land size of the district. The annual mean temperature ranges between 15.1 and 29.5°C and the annual mean rainfall ranges 900 to 1800 mm (LAR, 2013).

Data

A total of 230 goats keeping households were surveyed across the study sites for the participatory definition of selection criteria/breeding objectives and description of the production system. Identification of the breeding objectives traits in participatory manner are a recommended approach for the sustainable breed improvement programs in tropics (Sölkner et al., 1998; Gizaw et al., 2010b; Wurzinger et al., 2011). In the present study, participatory own flock ranking methods adapted from (Mirkena, 2011) were applied.

Statistical analyses

The SAS (2010) program was used to describe the survey data. Chi-square test was employed when required to test the independence of categories or to assess the statistical significance. Indexes were calculated for ranking data from individual households for site according to a formula: Index = sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) given for an individual reason (attribute) divided by the sum of (3 for rank 1 + 2 for rank 2 + 1 for rank 3) for overall reasons. Indexes so generated were then used to rank the pooled importance of each attribute as selection criteria in each of the three sites.

RESULTS AND DISCUSSION

Purpose of keeping goats

The households in the study area raise goats for multiple purposes. The ranking of goat breeding objectives by households are presented in Table 1. The results revealed that socio-economic (cash, asset, security) and production or yield attribute (meat) were ranked first and second preferred traits by farmers with index of 0.47, 0.44 in lowland; 0.45, 0.42 in midland and 0.47, 0.40 in highland areas. However, the socio-cultural (rites, ceremony, prestige and dowry) purpose was ranked third in all agro ecologies. The purpose of goat keeping in the present study was in complete agreement with the earlier report of Tekleyohannes et al. (2012) from South Omo where in households ranked socio-economic and production traits as first and second preference for goat keeping.

Purpose of goat marketing

These results showed (Table 2) that the main reasons for sale of goats were to generate income to meet demands of cash in all the three agro ecologies (94.4, 92.8 and 91.4% in lowland, midland and highland, respectively). This suggested that goats have high financial and insurance functions in the study area. Besides sale of goats are easy compared to larger animals. This makes them suitable commodity to mobilize in times of compelling and urgent financial needs. Farmers purchased goats mainly for production purpose in all agro ecologies (56.6,

Table 2. Purpose of goat marketing (%).

Factors	Lowland (%)	Midland (%)	Highland (%)	Total (%)
Sale of live goat				
Cash	94.4	92.8	91.4	93
Culling	2.2	2.8	4.3	3
Cash and culling	3.4	4.3	4.3	4
Purchase of live goat				
Production purpose	56.6	65.7	60	60.7
Fattening	26.6	17.1	18.6	20.7
Slaughter at festival	11.1	8.6	11.4	10.4
Combination of production, fattening and festival	5.6	8.6	10	8.2

Table 3. Own flock ranking for preferred female goats within different agro ecologies (%).

Factors	Lowland						Midland						Highland						Overall
	R1	R2	R3	R4	R5	I	R1	R2	R3	R4	R5	I	R1	R2	R3	R4	R5	I	I
Body conformation	37.7	31.1	15.6	4.4	3.3	0.25	31.4	14.3	5.7	24.3	5.7	0.19	28.6	24.3	11.4	20	11.4	0.22	0.22
Coat color	22.2	23.3	17.7	21.1	5.5	0.20	20.0	11.4	8.5	12.8	15.6	0.14	12.8	10.0	8.5	24.3	8.5	0.12	0.15
Mothering character	-	-	13.3	23.3	8.9	0.06	-	-	12.8	11.4	-	0.04	8.5	17.1	8.5	2.8	11.4	0.10	0.06
Lamb survival	-	-	15.5	15.6	8.1	0.06	12.8	22.8	24.3	20	-	0.18	15.7	5.7	17.1	5.7	18.8	0.12	0.12
Twining ability	24.4	13.3	9.0	23.3	24.4	0.18	22.8	14.3	30.0	24.3	8.7	0.21	12.8	14.3	-	-	-	0.08	0.16
Short kidding interval	1.3	15.6	4.4	3.3	8.9	0.06	1.4	5.7	8.5	-	11.4	0.04	1.4	7.1	14.3	5.7		0.06	0.05
Age at 1st maturity	-	-	4.4	3.3	12.2	0.02	-	-	-	-	14.3	0.01	-	-	8.5	8.5	14.3	0.04	0.02
Adaptation	14.4	16.6	23.3	5.5	12.2	0.16	11.4	28.5	10.0	7.2	20	0.16	20.0	21.4	25.7	24.3	20	0.22	0.18
Longevity	-	-	-	-	16.6	0.01	-	2.8	-	-	24.3	0.02	-	-	5.7	11.4	15.6	0.04	0.02

65.7 and 60.0% in lowland, midland and highland areas, respectively).

Adaptation traits, including grazing ability, disease resistance and ability to walk long distances were also mentioned as important preference reasons. The production system's conditions of complete dependence on utilization of natural resources, lack of inputs and the rigorous environmental conditions make adaptation traits the pervasively most important attributes both for survival and production.

Trait preference for does

The results of preferred female traits by farmers from own flock ranking experiments are presented in Table 3. Perusal of these results showed that the sampled respondent preference for trait differed in the three agro ecologies. The results pooled overall three agro ecologies showed that body conformation, adaptation, twining ability, coat color, lamb survival, mothering character, short kidding interval and age at first maturity/longevity were ranked as first, second, third, fourth, fifth, sixth and seventh traits with index value of 0.22, 0.18, 0.16, 0.15, 0.12, 0.06,

Table 4. Own flock ranking for preferred male goats within different agro ecologies (%).

Factors	Lowland						Midland						Highland						Overall
	R1	R2	R3	R4	R5	I	R1	R2	R3	R4	R5	I	R1	R2	R3	R4	R5	I	I
Adaptation	34.4	26.6	17.7	23.3	13.3	0.26	32.8	28.6	14.3	17.1	5.7	0.24	25.7	31.4	17.1	15.7	11.4	0.23	0.24
Body conformation	40.0	31.1	13.3	16.6	12.2	0.27	44.3	32.8	25.7	11.4	14.3	0.31	37.1	28.6	11.4	28.6	17.1	0.27	0.28
Coat color	20.0	24.4	27.7	23.3	5.6	0.22	12.8	17.1	10.0	28.6	11.4	0.15	31.4	22.8	20.0	14.3	11.4	0.23	0.20
Early maturity	-	5.5	12.2	13.3	26.6	0.07	-	4.3	18.6	22.8	28.6	0.10	-	-	22.8	18.6	29	0.09	0.10
Pedigree	3.3	7.7	23.3	5.8	18.8	0.10	10.0	11.4	10.0	5.7	7.2	0.10	5.7	5.7	17.1	-	-	0.07	0.08
Multiple birth	2.2	4.4	5.5	17.7	23.3	0.07	-	5.7	17.1	14.3	32.8	0.10	-	11.4	11.4	22.8	31.4	0.10	0.10

0.05 and 0.02/0.02, respectively, by farmers for selection of females. The ranking of trait preference by the farmers in the three agro ecologies showed some variance. The ranking of trait preference in order of descent was body conformation (0.25), coat color (0.20), twining ability (0.18), adaptation (0.16), mothering character/lamb survival/short kidding interval (0.06), age at first maturiry (0.02) and longevity (0.01) in lowland agro ecology.

Similarly the sampled respondents in midlands ranked traits in descending order as twining ability (0.21), body conformation (0.19), lamb suevival (0.18), adaptation (0.16), coat colour (0.14), mothering character/short kidding interval (0.04), longevity (0.02) and age at first maturity (0.01). In highlands body conformation / adaptation (0.22), coat colour/lamb survival (0.12), mother character (0.10), twinning ability (0.08), short kidding interval (0.06) and age at first maturity / longevity (0.04) were ranked as I, II, III, IV and V preferred trait in selection.

Trait preference for bucks

Table 4 shows the relative importance of different traits in male and female breeding goats as ranked by farmers across the sites. Results from the trait preference ranking for bucks shows that body size and conformation is among the top ranked attributes across sites. This shows that male goats are mainly kept for sale across the sites. High priority was also attached to coat color in selecting bucks at all the sites. This could be in response to the marketing system reported across the sites to be based on visual appraisal of animals' size, conformation and coat color and not based on body weights. Similar preferences to coat color where reported in Eastern Ethiopia in selecting male goats (Gebreyesus et al., 2013).

CONCLUSION AND RECOMMENDATION

The study shows that trait preferences reflect the general production environment and market preferences operating in specific sites. Results also show that adaptation traits need to be put into consideration apart from productive traits in designing breeding programs for three agro ecologies of Loma around Omo river Valley of southern Ethiopia. Based on the results of the participatory breeding objectives trait that the community based genetic improvement strategy, based on ranking of goat breeding objectives and selection criteria by farmers, should be given consideration while planning schemes for conservation, genetic improvement and sustainable utilization of Woyto-Guji goats

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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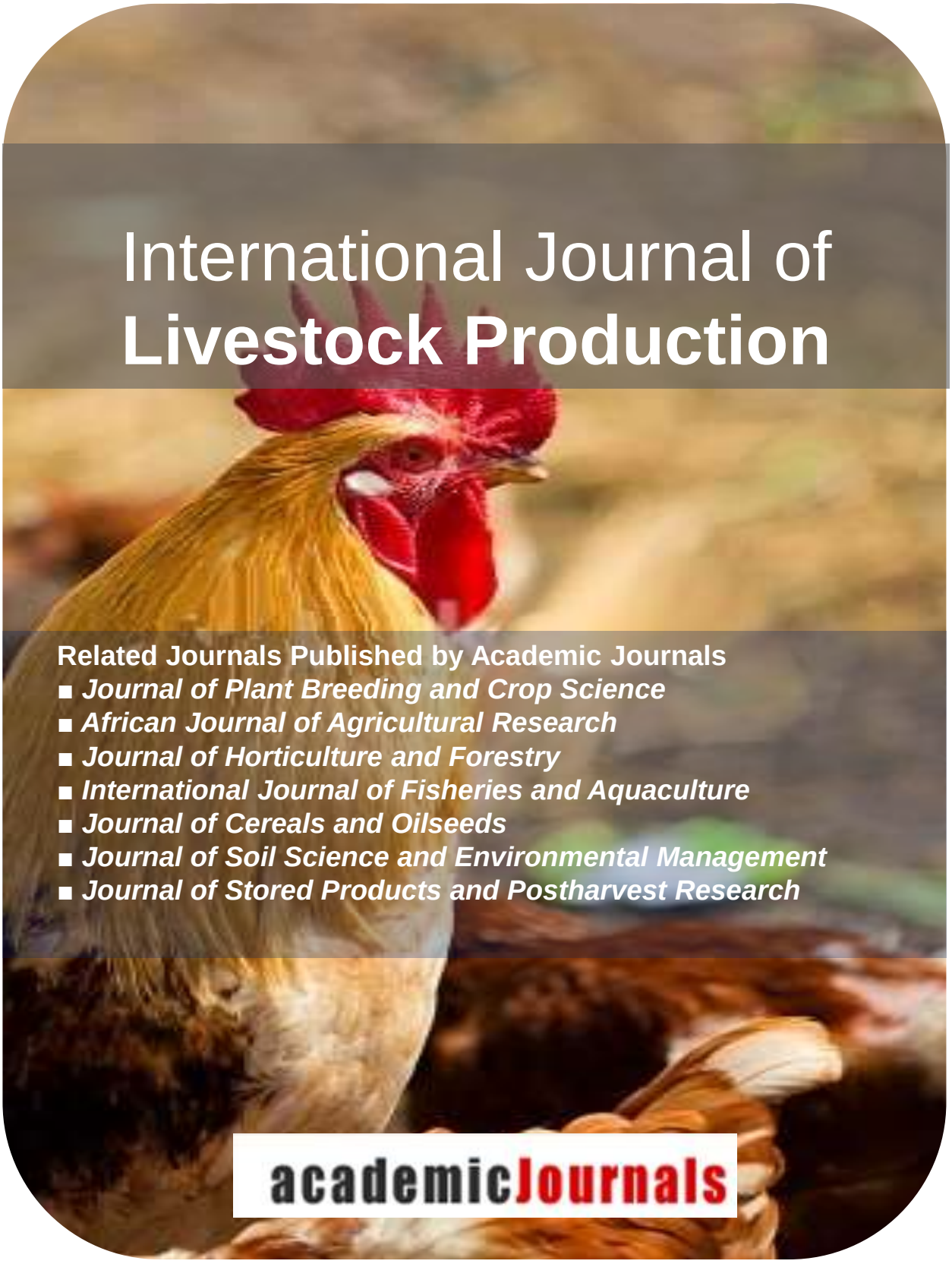

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