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PERFORMANCE OF BROILERS FATTENED ON LOCAL AVAILABLE FEED UNDER ADVERSE TEMPERATURES IN MALI, WESTERN AFRICA

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SUMMARY

Commercial broilers Cobb (C) and Ross (R) line were fattened during September-November, at abundant temperatures (23,9-38,2°C) in periurban location of Bamako (Rep. of Mali). Days 1-7 post hatch growth development was strengthened by feeding commercial starter (21,6% protein), days 8-42 broilers were fed with custom made mixture based on available components with bone (BM)- or fish (FM)-meal, containing 12,5% and 16% protein, respectively. On day 42, broilers C fed FM reached 1629 g live weight, 66,2% carcass yield and 198 g protein/100g meat, R fed FM 1485 g, 67,4 % and 199 g/100g meat. Both C and R fed BM grew slower (773g-65%-181g/100g, and 726g- 62,4%-183g/100g). By extending fattening period 7 days longer CFM and RFM reached 1742g/68,7% and 1576 g/67,4% as for live weight /carcass yield. Neither CBM nor RBM have reached comparable results even until 63 days of fattening (CBM 1404g/70,2% and RBM 1275g/71,3%). About 3% of birds in both groups gained after 63 days less than 1000 g live weight. Growth rate was influenced by feed intake suppression due to heat stress, after the daily average temperature exceeded the optimum more than 10%. Since day 22, daily temperature reached 107-164% optimal range, daily feed consumption dropped on 87-60% of advisable amount. Decreased body weight gain of the R in response to the heat stress was much more severe than that of the C.

Keywords : Broiler, growth, heat stress, local available feeds, bone meal, fishmeal

MATERIAL AND METHODS

Performance of two commercial broiler lines (Cobb 500, Ross 308) under adverse conditions of small-scale urban farming has been tested in Bamako city (West Africa). Batch of 100 straight-run (not sexed) non-vaccinated birds was fed diet consisting of locally available components during autumn season in litter pens. Factors influencing performance and profitability were evaluated to design technology for small-scale family plant. Day-old chicks (50 Cobb, 50 Ross) were placed into elevated litter pen and ad lib fed with commercial starter to day 7. Since day 7 birds were randomly allotted to 2 equivalent pens to create two test groups, each of 25 Cobb + 25 Ross : group L, ad-lib fed lower protein and group H, *ad-lib* fed higher protein local feed. Feed changeover from the starter to the local mash was carried out within 4 days since day 8 (25-50-75-100% of the total feed amount). On day 14 birds within both groups were again randomly separated so that in the final setout there were 4 equal pens by 25 chickens each. Birds were weighed on day 3,5,8,14,20,26,31,37 and on day 42, 50% of the heaviest chickens were slaughtered. The carcass yield and weight of individual body parts were determined. Breast and thigh muscles were evaluated for sensory characteristics (consumer panel test) and chemical composition. The rest of animals were slaughtered in weekly intervals to the day 63 and carcass yield was determined again.

Feeding

Commercial starter of 21,6% protein was used, growth stimulator (avilamycin plus avizyme) and coccidiostat enriched. The local mash feeds were prepared in local milling/mixing plant in 14 days intervals and despite the same formula, the nutrient content ex-post laboratory determined varied according to available component quality. Feeds offered during days 11-30 were of 16% crude protein (CP) and 4,15% crude fat (CF) for the H group and 12,5% CP and 3,27% CF for the L group. Since day 31, these values were 16,5% CP and 4,84% CP for the H group and 14,6% CP and 3,05% CF. Feeds were offered 2-5 times a day depending on temperature (at 7-9-13-17-19hrs), refusals were weight daily. Drinking water was offered and changed, as needed, usually 3times a day. During days 14-21 and 28-42 locally available vitamin-amino acid premix (375mg amino acids/1g) was administered into the water to eliminate the nutrition and environmental stress.

Pens

Elevated pens were made and furnished from locally available materials (wood/plywood, wire mesh, wooden shavings, plate troughs, plastic drinkers) and protected from direct sunshine and rain with grass mats and scroll plastic sheet. Stocking density reached max. 6,9 kg/m^2, 19,5 kg/m^2 17,5kg/m^2 during days 0-7, 8-14, 15-42, and 42-63 respectively. Trough length available per bird has been 3, 6 and 12 cm and drinker capacity 5-10 and 20 liters/100 birds.

Environment

The test was planned to involve partly the adverse rainy period, during September-November. The ambient temperatures and relative humidity were recorded at 3 hours intervals and based on these the temperature-humidity index (THI) calculated. Pens were placed on the storied house flat roof in a rather noisy street (the average number of motor vehicles passing per hour between 8-11 and 17-22o´clock reached 1000-1600) but chicken adapted to the traffic jam quite easy.

RESULTS

Feed consumption and growth rate

The feed consumption reflected environmental conditions, especially the high temperature impact. During days 1-7 the average consumption differed from that designed for industrial poultry operations only slightly, as the temperature did. Just as the difference between the recommended and actual temperature increased, the consumption decreased. The different consumption per kg live weight between feed types is significant, markedly from day 20 (figure1). Growth rate as measured by the live weight achieved on days 3, 8, 14, 20, 31 and 42 differed across strains, sex and feed types (figure 2).

Table1. Significance of live weight differences

Significance of differences	Within	D 3	D 8	D 14	D 20	D 31	D 42
Between strains (Cobb : Ross)	H protein	ns	*	***	***	***	***
	L protein	ns	*	*	***	*	ns
Between feeds (H : L protein)	Ross	ns	ns	ns	***	***	***
	Cobb	ns	ns	ns	***	***	***
Between sexes, by L protein	Cobb	*	ns	*	***	***	***
	Ross	ns	ns	ns	ns	***	***
Between sexes, by H protein	Cobb	ns	ns	ns	ns	***	***
	Ross	*	ns	ns	ns	*	***

The live weight difference between strains became evident since day 20 both at lower and higher protein feed (287 to 311g and 397 to 357g). However in the lower protein group the significance decreased and on day 42 the difference was not significant (ns, 726 to 773g), unlike the higher protein group where the highest difference were on day 42 (1629 to 1485 g). The live weight differences between feed types are significant (*p>0,05 and *** p>0,01 since day 20 (356 to 378g), reaching maximum again on day 42.

On the slaughter day all birds were sex determined so that differences between males and females would be evaluated (in the lower protein group only males were slaughtered). By higher protein feed the differences were significant especially in the finishing fattening phase (1681 to 1570g in Cobbs and 1520 to 1317g in Rosses on day 42), meanwhile by lower protein feed the significance occurred earlier (450 to 396g in Cobbs and 431 to 367g in Rosses on day 31; 895 to 692g in Cobbs and 839 to 686g in Rosses on day 42). It indicates that at lower protein feeds the strain type did not play the main role and that males grew better then females.

Carcass yield

Carcass characteristics in chickens on day 42 varied across feed types, sexes and breeds. Carcass yield differed significantly between feed types within the same age because of different live weight achieved. Slightly better yield in the Rosses caused probably heavier leg bones and stomach/gut content detected in Cobbs (Table 2)

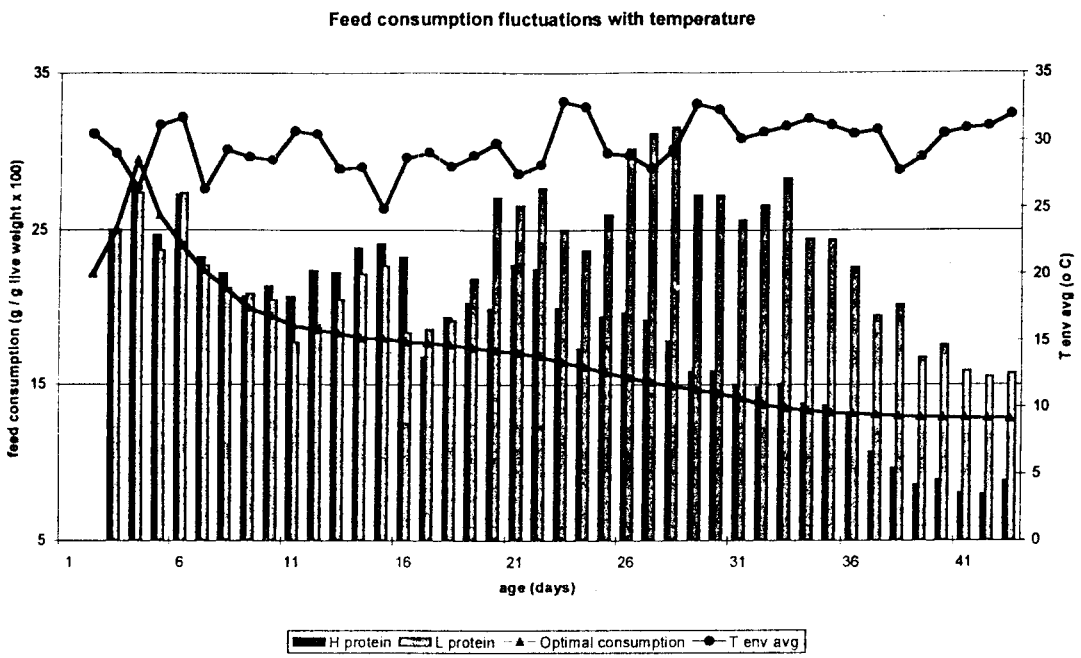
Feed consumption fluctuations with temperature
feed consumption (g / g live weight x 100)
T env avg (o C)
age (days)
H protein
L protein
Optimal consumption
T env avg

Figure 1

Figure 2. Growth rate and feed protein content

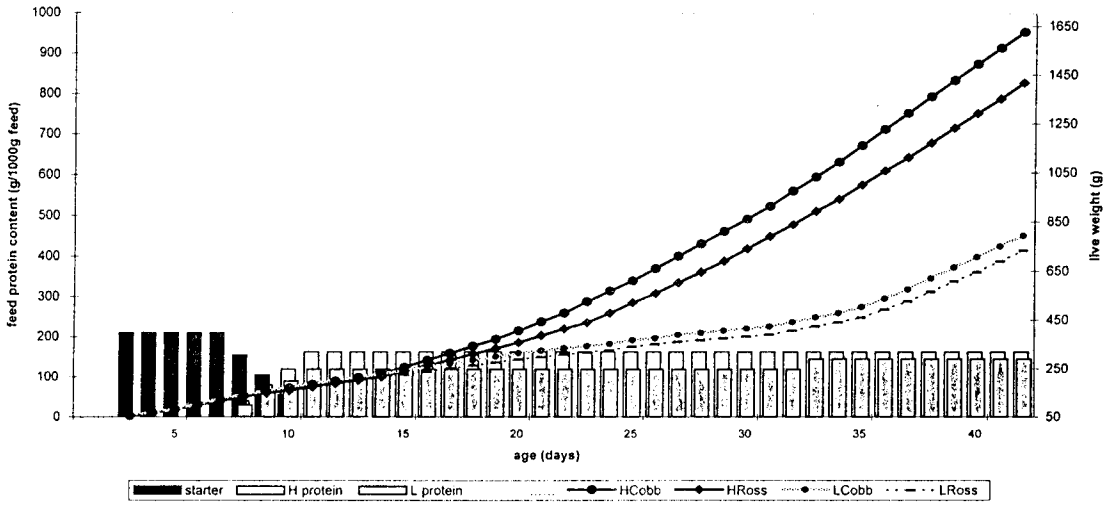

Table 2. Carcass characteristics on day 42

Groups	Live weight (kg)	Carcass yield (%)	Breast meat yield (%)	Thigh meat yield (%)	Meat : bone ratio
H Cobb, males	1653	66,25	14,4	29,7	2,69
H Cobb, females	1581	66,2	20,9	30,5	2,62
H Cobb, average	1679±125,1	66,2±0,8	18,3±3,3	30,2±1,2	2,64
H Ross, males	1525	66,8	15,0	32,0	2,78
H Ross, females	1418	67,7	19,8	31,2	2,66
H Ross, average	1476±118,3	67,4±0,9	17,4±2,5	31,6±1,5	2,73
L Cobb, males	949±100,2	65,0±0,22	13,7±1,0	32,7±0,8	2,35
L Ross, males	881±118,3	62,4±0,46	16,1±0,7	33,2±1,2	2,27

The remaining chickens fed H protein feed were slaughtered on day 49, chicken fed L protein were fattened to day 56/63. Carcass yield of birds slaughtered on day 49 and 56/63 was as follows:

Table 3. Carcass characteristics by extended fattening

	Day 49		Day 56/63	
Groups	Live weight (kg)	Carcass yield (%)	Live weight (kg)	Carcass yield (%)*
H Cobb	1742±113,4	68,7±1,5	-	
H Ross	1576±192,8	67,4±1,4	-	
L Cobb	1392±105,8	68,9±1,1	1404±174,3	70,2±1,9
L Ross	1340±146	67,1±1,4	1275±150,2	71,3±1,8

* another butcher styled the carcass bodies

Meat composition

Differences between H and L protein feed resulting from different body composition are evident, yet significant only in dry matter and protein content probably due to great dispersion of numbers obtained.

Table 4. Chemical composition of breast/thigh meat

Groups	Dry matter g/kg	Protein g/kg	Fat g/kg	Ash g/kg	Energy MJ/kg
H Cobb, average	267,8±3,25	198,1±6,09	56,6±5,88	10,3±0,13	5,47±0,20
H Ross, average	266,8±5,25	198,9±4,65	57,1±6,88	10,1±0,32	5,40±0,43
L Cobb, average	247,8±3,18	180,8±1,39	54,5±3,26	9,4±0,27	5,17±0,16
L Ross, average	252,0±1,95	183,3±1,42	56,9±1,81	9,8±0,24	5,26±0,11

Consumer acceptance evaluation

Quality of meat from tested chickens fed fish meal, meat-bone meal and local type obtained at the city market was evaluated. Panel of 9 consumers (5 local without prior experience of broiler meat, 4 European living long-time in Africa, 5 women and 4 men) evaluated cooked breast and thigh meat along with standard method for odour, tenderness, flavour and overall acceptance. Characters were scored on the scale 1 to 5. No adverse odours or flavour were noted.

Table 5. The results of consumer acceptance panel test of breast/thigh meat

Characters	Fish meal		Meat-bone meal		Cockosh (local breed)	
Overall acceptance	1,85	Super	2,71	plus	3	current
Odour	1,85	delicious	2,57	pleasant	2,71	current
Texture (tenderness)	2,14	Soft	2,57	moderate	3	tough
Flavour	3	savoury	2,28	tasty	1,85	dry

The recommended amount of fish meal in broiler feed is about 5% as for sea fish. Possible adverse influence of the fish meal on the meat flavour is caused by volatile free fatty acids, whose content and type is different from that of freshwater fish. The quality of local fish meal is variable depending on the season. During and shortly after the rainy season fish crop from the Niger River is scarce so that only fish crumbs and sand impregnated with fish oil from the place where fish are dried and smoked is available. Thus the true fish content in the feed mash prepared with such „fish meal" is about 8-9%. Therefore, freshwater fish meal can be incorporated into the chicken diets at levels of 8-9% (true fish content) without causing objectionable sensory characteristics in the cooked broiler meat.

Feed conversion rate

The average feed consumption and conversion rates by standard (42 days) and extended fattening (49 days for H protein and 56/63 days for L protein) were as follows :

Table 6. Feed consumption and feed conversion rate

Group	42 days Total (g)	kg/k glive weight	kg/kg carcass	Extended fattening Total (g)	kg/kg live weight	Kg/kg carcass
H protein	2995	1,92	2,78	3750	2,24	3,96
L protein	3040	3,54	4,58	4960	3,70	5,24

DISCUSSION AND CONCLUSIONS

Weight gain and feed consumption achieved in broilers exposed to true multiple stress conditions represented by cycling high temperature and/or humidity and feed protein shortage corresponds to those achieved under experimental conditions (YAHAV 1996 and 2000, MENDRES et al 1997, COOPER 1998). The results indicate the possibility to use described technique in designed system of urban poultry growing. Very low mortality data (zero and 3% in the first two crops) were definitely influenced by the fact that the fattening units were newly established and there is a need to trace them during next periods, to state the minimal preventing treatment (vaccination and medication) requirement. The most important however remains the strict hygienic regimen. The second essential condition assumed is the availability of starter feed during the 1-7th day of age and application of amino acid-vitamin supplement into drinking water reducing the stress load (FERKET 1992, Mc KEE 1995, 1997). Lack of protein in local feeds could be balanced (where available) by higher proportion of freshwater fish over recommended 5% level. No adverse sensory effect on meat when higher amount of freshwater fish in feed has been used (to 9% of true fish part) was declared by panel test. This is supposedly because of different content of long-chain polyunsaturated fatty acids in sea and freshwater fish (0,8-1,2 vers. 0,2-0,4 g/100g). This corresponds to results described by LOPEZ-FERRER (1999). Therefore, freshwater fish meal can be incorporated into the chicken diets at levels of 8-9% (true fish content) without causing objectionable sensory characteristics in the cooked broiler meat. Birds of varied inherent growth rate developed different respond to multiple environmental stress, however predicting the economic performance still remains difficult due to variability of stressors. Under described conditions, the best results have been achieved with the Cobb 500 strain males, fed 16% crude protein mash and slaughtered at 42 days of age.

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