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Peri-urban poultry production in Uganda: influence of commercial feedstuffs on broiler growth performance

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1 Introduction

With rapid urbanisation and deterioration of economic conditions in developing countries, a growing number of urban families are raising small animals such as poultry for their livelihood (WATERS-BAYER, 1995). A major problem faced by animal farmers in cities is the high rate of livestock mortality (LEE-SMITH AND MEMON, 1994). In Uganda, although peri-urban poultry farming is on the increase (MAAIF, 1993), a large number of urban farmers afford only very limited amounts of purchased feeds (MAXWELL AND ZZIWA, 1992) resulting in fluctuations of meat and eggs production (MAAIF, 1993). Adequate feed supply and the efficient use of this feed are important in poultry production. Besides having a significant influence on the infection rate and disease resistance of birds, feed is the most costly item, constituting 60-75% of broiler production costs. Optimal production targets in modern broiler units are: 1 kg of meat from 2.1 kg of feed and average liveweight of 2 kg at 6-7 weeks of age (ENSMINGER et al., 1990). Data on the quality of poultry feed in Uganda is scanty. Precise investigations on feed nutrient availability and how this influences poultry performance are lacking (MAAIF, 1993). Therefore, this study was designed to assess the influence of commercial feedstuffs on broiler production through combined laboratory analyses and growth performance trials, and to verify feeding factors that lead to fluctuating broiler performance and productivity in the country. The study was focused on the assumption that the quality of commercial feed mixtures in Uganda has a negative influence on peri-urban poultry performance. Literature of interest, along with details on broiler nutrient requirements, feeding and management are extensively reported (SCOTT et al., 1982; NRC, 1984; WISEMAN, 1987; AUSTIC AND NESHEIM, 1990; SMITH, 1990; ENSMINGER et al., 1990).

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2 Materials and Methods

480 Ross breed broilers (slaughter age = 7-8 weeks; slaughter weight = 2000-2500g), at day-old and weighing approximately 50 g each were purchased from a local distributor, randomly divided into 8 treatment groups of 30 birds per pen in duplicate lots (as-hatch basis) and housed in a deep litter system for the entire experimental period of 8 weeks under standard management. One group was fed a control diet (Table 1) designated Fs and the other 7 test groups fed 7 different commercial broiler feed mixtures (broiler mash) purchased in Kampala and designated F1, F2, F3, F4, F5, F6, F7. The quality of feeds was monitored weekly for 8 weeks by standard methods (NEUMANN-NEUDAMM, 1983) and the feeds assessed for their nutrient content (Table 2). Metabolisable energy was determined according to the equation of the World Poultry Science Association (VOGT, 1984; cited in CLOSE AND MENKE, 1986). Broilers were weighed once weekly while feed offers and refusals per treatment group were measured daily at 0600 h and the corresponding feed intake calculated. Broiler mean performance characteristics (Table 3) were tested for significance of differences using the standard t-test for paired differences.

Table 1: Gross nutrient composition of the control diet (Fs) used in the study

Ingredient	Quantity (kg)	ME (kJ/g)	CP (%)	Ca (%)	P (%)	CF (%)
Maize meal	65.0	9.55	5.20	0.01	0.26	1.46
Soya meal	16.0	2.32	5.92	0.04	0.64	0.69
Fish meal	9.0	1.13	5.85	0.45	0.24	0.00
Blood meal	7.0	0.82	5.60	0.02	0.02	0.00
Bone meal	2.4	0.03	0.60	0.53	0.22	0.00
Common salt	0.25	-	-	-	-	-
Premix*	0.35	-	-	-	-	-
Calculated total	100	13.85	23.17	1.05	1.38	2.15
Actual total	100	13.21	21.32	0.95	0.82	3.45

* Obtained from Nova Chemical Co. Ltd., Kampala Uganda
CP = crude protein; ME = metabolisable energy; CF = crude fibre; P = phosphorus; Ca = calcium

3 Results and Discussion

Tables 2 and 3, and figures 1, 2 and 3, present a summary of the results. The nutrient content of the various commercial broiler feed mixtures was not constant. Energy-protein imbalances were evident in nearly all the commercial feeds (Table 2) except F5 and F7. Feed F2 (ME:CP ratio = 869.6) had the highest protein-energy mismatch followed by F3 (ME:CP ratio = 822.9). Both were 35.9% and 28.6% respectively outside the normal ME:CP range (590-640) for broilers. Except for feed F7, indigestible bulk (crude fibre content) exceeded the recommended limit for broilers (CF% < 4), being highest in F2 (CF% = 6.3) and marginal for other commercial diets (Table 2). The Ca:P ratios of F1 (ratio = 3.1) and F2 (ratio = 4.1) appeared to be in excess of the requirement.

Table 2: Mean nutrient content of major Ugandan commercial broiler feed mixtures in relation to recommended dietary levels.

Nutrient		CP* (%)	ME** (kJ/g)	ME:CP	CF (%)	P (%)	Ca (%)	Ca:P ratio
F1	Mean	14.8	11.8	786.66	4.4	0.62	1.92	3.1
	Range	13.5-16.0	11.5-12.1	620-936	3.8-5.0	0.52-0.9	1.4-2.67	2.1-3.5
F2	Mean	11.5	10.0	869.56	6.3	0.51	2.1	4.12
	Range	9.8 -13.7	8.9-12.1	650-1190	4.8-8.9	0.42-0.75	1.48-3.05	2.0-7.3
F3	Mean	17.5	14.4	822.86	4.5	0.68	1.2	1.76
	Range	16-19.5	13.8-14.7	730-930	4.2-6.2	0.6-0.8	0.89-1.57	1.4-2.5
F4	Mean	16.8	11.9	708.33	4.4	0.53	1.38	2.6
	Range	15.5-16.5	11.6-12.2	612-750	4.0-5.3	0.47-0.7	0.9-1.51	1.7-2.73
F5	Mean	17.9	13.7	685	4.3	0.65	1.3	2.0
	Range	16.3-21.0	12.0-12.6	622-694	3.7-4.9	0.56-0.82	0.82-1.49	1.67-2.6
F6	Mean	19.0	12.5	625	3.9	0.63	1.32	2.1
	Range	16.3-21.3	13.1-14.3	580-697	2.3-5.9	0.5-0.8	0.98-1.86	1.5-2.4
F7	Mean	20.0	13.4	609	2.7	0.63	1.06	1.3
	Range	17.0-22.9	11.9-13.9	609-652	3.5-4.4	0.49-0.88	0.94-1.44	1.64-2.3
Fs	Mean	21.4	13.4	609	2.7	0.63	1.06	1.3
	Range	19.2-22.1	13-13.85	580-659	2.2-3.1	0.55-0.83	1.01-1.2	1.0-1.8

Fs = Control feed; CP = crude protein; ME = metabolisable energy; CF = crude fibre; P = phosphorus; Ca = calcium; Ca:P = calcium-phosphorus ratio; ME:CP = metabolisable energy-protein ratio.

Recommended range of values:
CP% ->19 -21; ME (kJ/g) -> 11.7-14.3, ME:CP ratio (kJ/kg : %CP) -> 590-640; CF < 4%; P ->0.5%; Ca->0.6-1.3%; Ca:P ratio ->1.0-2.0 (LEWIS, 1978; SCOTT et al., 1982; SMITH, 1990).

* = minimum broiler protein requirement in first 5 weeks is 21% and from 5-10th week is 19% (SMITH, 1990).

** = dietary ME range for voluntary regulation of energy and nutrient intake in poultry is 11.7 - 14.3 kJ/g. Critical ME level at which weight loss begins in warm climates is 10.0 kJ/g (SCOTT et al., 1982).

Table 3: Performance characteristics of broilers fed 7 commercial broiler feed mixtures in Uganda

Parameters	**Feed**							
	F1	F2	F3	F4	F5	F6	F7	Fs
Mean feed consumed, g/bird/week ± SE	903.0^{b} 21.3	814.8^{b} 19.2	901.6^{b} 20.5	584.1^{a} 13.4	982.9^{c} 26.8	766.9^{b} 22.0	845.0^{b} 20.6	765.1^{b} 20.9
Mean weight gain, g/bird /week ± SE	184.7^{a} 8.6	90.9^{a} 6.8	363.7^{c} 28.3	203.8^{a} 14.4	308.8^{b} 16.2	299.8^{b} 19.0	320.0^{b} 15.6	302.9^{b} 18.5
Mean feed efficiency ratio (FER) ± SE	5.3^{a} 0.51	6.6^{a} 0.4	2.46^{b} 0.15	2.48^{b} 0.2	2.69^{b} 0.16	2.7^{b} 0.18	2.61^{b} 0.18	2.34^{b} 0.17
Mean protein efficiency (PER)±SE	2.0^{b} 0.2	2.0^{b} 0.29	2.68^{b} 0.21	2.3^{b} 0.2	2.3^{b} 0.2	2.2^{b} 0.21	2.1^{b} 0.28	2.1^{b} 0.29
Mean final body weight, g/bird ± SE	1478.9 83.2	770.7 70.3	3103.7 149.3	1666.4 86.4	2470.0 101.5	2398.0 93.1	2582.9 99.6	2499.6 95.4

F1-F7 = Commercial broiler feed mixtures
Fs = Control feed
a = Significantly lower ($p<0.05$) values from (Fs)
b = Not significantly different values from (Fs)
c = Significantly higher ($p<0.05$) values from (Fs)

Mean liveweight gain/bird and week in groups fed F1, F2 and F4 (Table 3) were significantly lower ($p<0.05$) than that for the control diet. Liveweight yield at maturity of F3 fed broilers (3103.67 g/bird) was higher than that of the control diet Fs by 24.2%, while F1, F2 and F4 fed broilers weighed 40.8%, 69.2% and 33.3% lower respectively (Figs. 1 and 2). F2 fed broilers lost on average, 7.4 g /bird and day in week 8 (Figs. 1 and 2). Based on the results of liveweight gain and its significance difference ($p<0.05$) from that of control diet formulated according to recommended standards in the tropics, Ugandan commercial broiler feeds were categorized (Fig. 3) into 3 feed classes viz., low class (significantly lower), medium class (not significantly different) and high class feeds (significantly higher liveweight gain). The low liveweight gains of F1 and F2 fed broilers could be attributed to the very low nutrient content and their imbalances observed in these feeds (Table 2), supporting the assumption that the quality of Ugandan commercial feeds has a negative influence on peri-urban poultry production. On the other hand, the high liveweight gains in F3 fed broilers could be probably due to the high ME levels in this feed (Table 2) that tended to be above the normal ME range for voluntary feed-intake regulation in broilers. Feeds with such energy level have higher tendencies to carcass fat deposition, and achieve the desired final body weight in a shorter time (FARELL, 1978). However, a higher liveweight yield of F3 fed broilers, may not signify a better carcass quality and health status of such broilers.

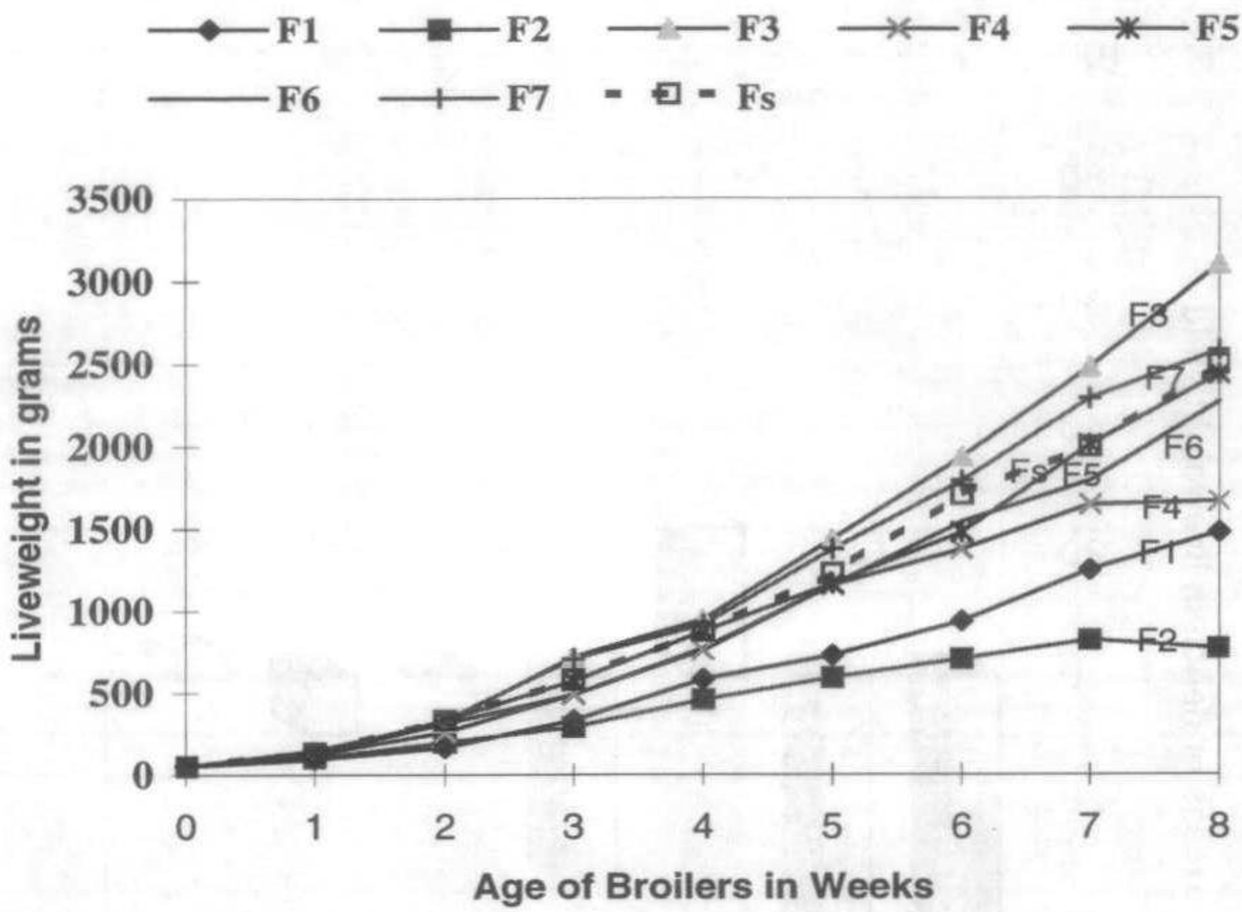

Fig. 1. Liveweight yield and growth patterns of broilers fed different Ugandan commercial broiler feed mixtures.

The mean feed efficiency ratio (FER) ranged from 2.34 to 6.6 kgs of feed per kg of broiler meat produced (Table 3). The FER of F1 (5.3) and F2 (6.6) were significantly ($p<0.05$) higher than that of broilers fed control diet (FER = 2.34). On the contrally, FERs of other commercial diets (Table 3) were not significantly ($p>0.05$) different. The low feed efficiency of some commercial feeds observed here, does not concur with modern standards (ENSMINGER et al., 1990) of broiler production, where 2.1 kg of balanced feed / kg broiler meat is the target. Hence, poultry farmers using such feeds face serious risk of losses. On the other hand, the FERs of broilers fed commercial diets F3, F5, F6 and F7 (Table 3), are consistent with those reported by other authors (OYEJIDE et al., 1984; ENSMINGER et al., 1990) suggesting a good level of feed management by some feed suppliers in Uganda. Similar to reports of other authors (OYEJIDE et al., 1984), the mean protein efficiency ratio (PER) of 2.0 in the low class feeds F1 and F2 did not differ significantly ($p>0.05$) from that of the control (PER=2.68) and other commercial diets (Table 3). Generally, the results indicate that about 28.7% of the commercial feed mixtures supplied, should lead to significant failure in attaining mature age liveweight of broilers, when fed un-altered for the entire growth period. In practice, small-holder farmers using such feeds may react to this problem by adopting a strategy of changing from feed to feed or making own on-farm mixtures, which in turn has other negative consequences on broiler production.

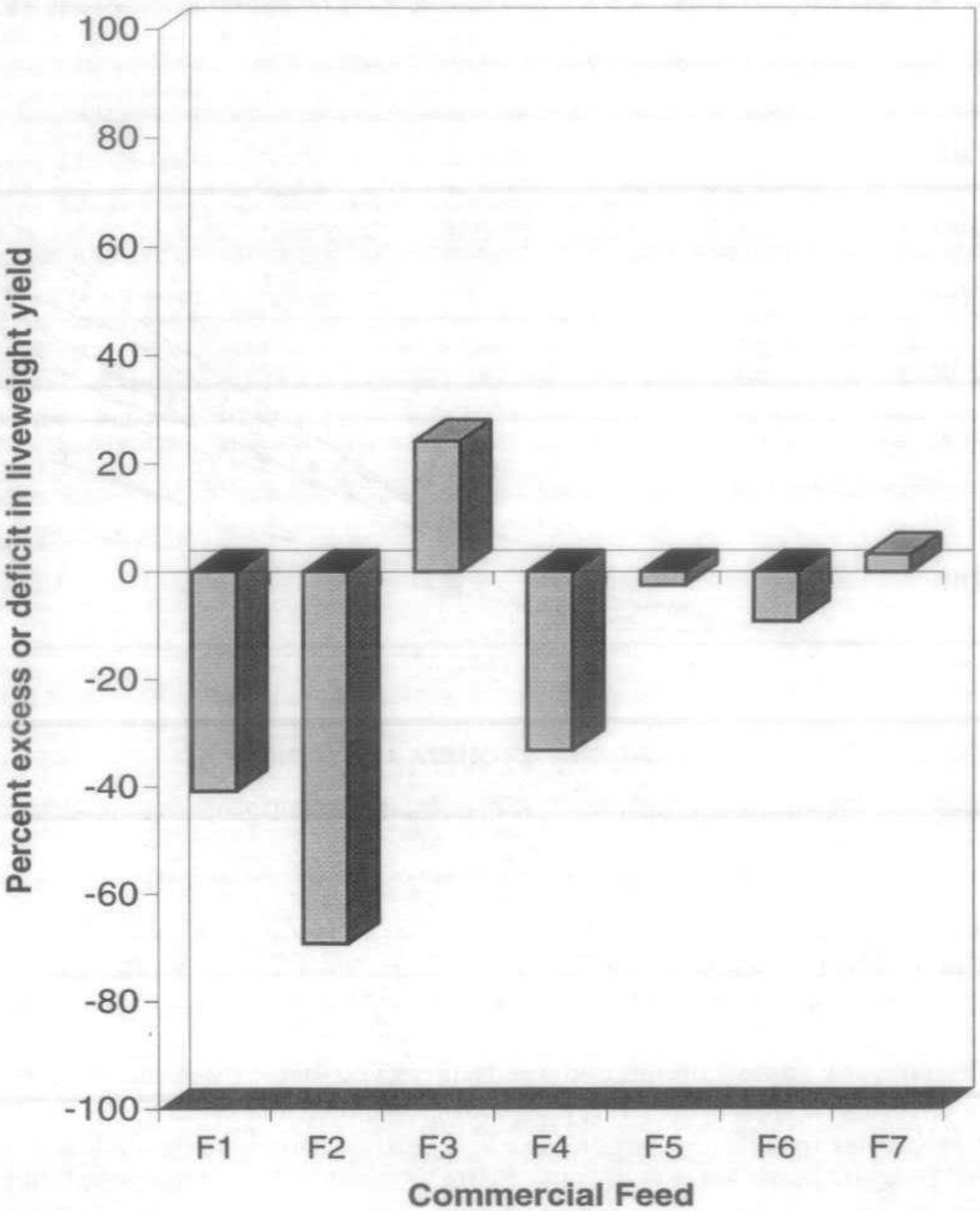

Fig. 2. Excess or deficit liveweight yield of broilers at 8 weeks of age expressed as percentage of the control diet liveweight yield (2499.6 g/bird)

We note that the quality of some Ugandan commercial feeds is not constant leading to wastage of nutrients consumed and reduced growth performance of broilers. The 3 classes of feed observed here as well as their diverse nature in quality, clearly demonstrate a need for standardisation of poultry feed quality marketed in Uganda.

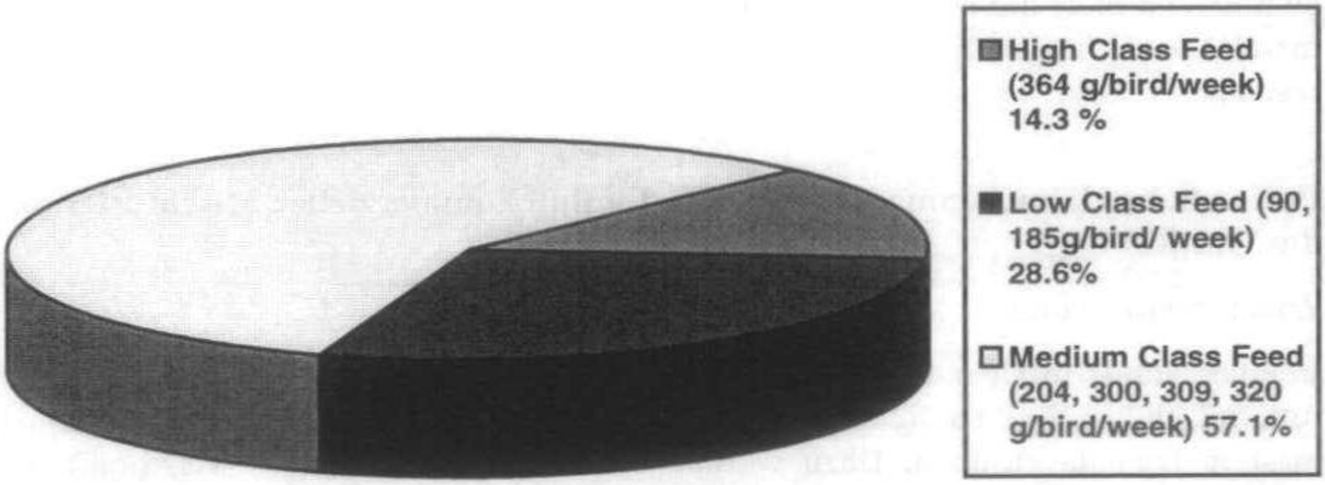

Fig. 3. Percentage of commercial broiler feed suppliers in Uganda according to class of broiler liveweight yield.

NB: Feed classification was based on significance difference ($p<0.05$) between liveweight yield of broilers fed commercial diets and those fed a control diet. Control diet was formulated according to recommended standards (Smith, 1990) in the Tropics. Low class = significantly ($p<0.05$) lower liveweight gain; Medium class = not significantly different; High class = significantly higher ($p<0.05$) liveweight gain

4 Summary

The question of whether commercial poultry feedstuffs have a significant negative influence on peri-urban broiler production in Uganda was investigated. 480 day-old Ross breed broiler chickens, in 8 duplicate groups of 30 birds each were housed in a deep litter system for 8 weeks under standard management. One group fed a control diet (designated Fs) and the other fed 7 different commercial broiler diets (designated F1, F2, F3, F4, F5, F6, F7) were monitored for their daily feed intake and weekly weight gain. Feeds were assessed for their nutrient content and broiler mean performance characteristics tested for significance of differences using the standard t-test. The nutrient content of the various broiler feed mixtures was not constant. Energy-protein imbalances were evident in all commercial feeds except for two (F5 and F7), with commercial feed F2 having the highest protein-energy mismatch (ME:CP ratio = 869.6) followed by F3 (ME:CP ratio = 822.9). Indigestible bulk exceeded the recommended limit for broilers in all feeds except feed F7, being highest in F2 (CF% = 6.3). F1 and F2 mean liveweight gains of 184.7 and 90.9 g/bird and week respectively, were significantly lower ($p<0.05$) than for the control diet (302.9 g/bird and week). Mature age liveweight yield of F3 (3103.67 g/bird) was higher than that of the control diet (Fs) by 24.2%, while F1, F2 and F4 liveweight yields were 40.8%, 69.2% and 33.3% lower respectively. F2 fed broilers lost 7.4 g /bird and day in the eighth week. Based on results of liveweight yield, 3 classes of feed were observed among the commercial feeds supplied in Uganda viz., low class (28.6%), medium class (57.1%) and high class feeds (14.3%). The mean feed efficiency ratios (FERs) were significantly ($p<0.05$) high in the low class feeds, being 5.3 (for F1) and 6.6 for F2. On the contrally, FERs of other commercial diets did not differ significantly. It was concluded that the quality of commercial feeds has a significant negative influence on peri-urban poultry production in Uganda.

Peri-urbane Hähnchenmast in Uganda: Einfluß kommerzieller Mischfutter auf die Mastleistung

Zusammenfassung

In einer Studie in Uganda wurde untersucht, ob kommerzielle einheimische Geflügelfuttermischungen einen signifikanten Einfluß auf den Erfolg peri-urbaner Hähnchenmast in Uganda ausüben. Dazu wurden 480 Eintagsküken (Ross Mastlinie) in 2x8 Gruppen mit je 30 Tieren zufallsmäßig aufgeteilt und 8 Wochen lang unter standardisierten Bedingungen auf Tiefstreu gehalten. An eine Gruppe wurde eine Kontrolldiät (bezeichnet als Fs) verfüttert, die übrigen erhielten 7 verschiedene Handelsmischfutter für Masthähnchen (F1 bis F7). Die Futteraufnahme wurde täglich, die Gewichtsentwicklung wöchentlich erfaßt. Unterschiede in den Leistungsdaten zwischen den Gruppen wurden mittels t-Test statistisch überprüft. Die untersuchten Mischfutter unterschieden sich deutlich hinsichtlich ihres Rohnährstoffgehalts. Mit Ausnahme von zwei Futtermischungen (F5 und F7) wiesen die Testdiäten Protein-Energie-Imbalancen auf, vor allem Futter F2 (ME:RP=869,6) und Futter F3 (ME:RP=822,9). Der Anteil unverdaulicher Bestandteile überstieg in allen Futtermischungen, außer in F7, die empfohlenen Höchstmengen, besonders in F2 mit einem Rohfaseranteil von 6,3%. Mit Futter F1 und F2 wurden mittlere Gewichtszunahmen von 184,7 bzw. 90,9 g pro Tier und Woche erzielt, die signifikant ($p<0,05$) unter der Leistung der Kontrollgruppe mit 302,9 g pro Tier und Woche lagen. Futter F3 führte zu einem um 24,2% höheren Mastendgewicht im Vergleich zur Kontrollgruppe (Fs), während die Mastendgewichte in den Gruppen F1, F2 und F4 um 40,8%, 69,2% bzw. 33,3% unter dem Ergebnis der Kontrollgruppe lagen. Bei F2-gefütterten Tieren wurde ein Gewichtsverlust von 7,4 g pro Tier und Tag in der 8. Versuchswoche beobachtet. Ausgehend von den ermittelten Mastleistungsdaten wurden die ugandischen Handelsmischfutter in drei Klassen eingeteilt, wobei 28,6% der untersuchten Mischungen der unteren Qualitätsstufe zugeordnet wurden, 57,1% der mittleren und 14,3% der oberen Qualitätsstufe. Die Futterverwertung war bei Verfütterung der Futtermischungen der unteren Qualitätsstufe signifikant verschlechtert ($p<0,05$) mit 5,3 für F1 und 6,6 für F2. In den übrigen Qualitätsstufen variierte die Futterverwertung nicht signifikant. Die Ergebnisse zeigen, daß die Qualität der Handelsmischfutter den Erfolg der peri-urbanen Hähnchenmast in Uganda signifikant beeinflußt.

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