A comparison of the performance of village chickens, under improved feed management, with the performance of hybrid chickens in tropical Zimbabwe

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ABSTRACT: A study was conducted to evaluate the performance of village chickens under an improved feeding management system in Zimbabwe. Commercial hybrid chickens of the same age as the village chickens were raised under similar conditions in order to establish the degree of performance variation between village and hybrid birds. Seventy day-old broiler chicks from each breed were randomly grouped into ten groups of seven chicks and randomly allocated to 20 pens. Broiler starter feed (0 – 28 days) and finisher (29 – 112 days) was given *ad libitum*. Weight gain and feed conversion ratio (FCR) were significantly lower in village chickens than in the hybrid birds. The latter were 78% heavier at 56 days of age with mean FCR of 2.5 compared with FCR of 4.7 in village chickens. Village birds are generally kept on a free-range system, requiring minimal resource input. As shown in this study, their limits of performance are rapidly reached when feeding and management are improved. However, they can supply local populations with additional income (Z$58.00 net profit per bird; return per dollar invested of Z$1.5) and high quality protein (crude protein, CP, 73%) compared with CP, 68% in hybrid chickens. High mortality, especially during the brooder phase (0-21days) constitutes a greater constraint on village poultry production. The formulation of low-input diets, utilising locally available feed resources, and crossing with selected varieties of birds, could improve the performance and profitability of village chickens.

Introduction

Village or indigenous chickens *(Gallus gallus domesticus*) are the most common types of poultry raised in the rural areas of Zimbabwe. Approximately 80 percent of poultry in Africa are raised in rural areas where they contribute substantially to egg and meat production (Sonaiya, 1997). In general village producers keep small flocks of between 5 to 20 birds per household (Gueye, 1997).

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Village chickens are generally raised on a free-range system where they survive as scavengers. They are maintained with low land, labour and capital costs, resulting in almost every household and the poorest social strata of the rural population keeping them. Based on low inputs and outputs, village chicken production represents an important part of a balanced farming system with a unique role in the economy of the rural household. They are a source of high quality protein for the family, provide a small income and play a part in the cultural life of the society. Reports in literature have revealed that indigenous chickens take long to reach maturity and lay fewer clutches of eggs per year compared to modern breeds (Safalaoh, 1997). There is limited information on the meat potential of village chickens and their performance under improved feeding management has not been fully characterised in Zimbabwe.

The objective of the current study was to evaluate the potential of village chickens for meat when given an improved feeding management system commonly used with hybrid birds; and to evaluate the economic returns of keeping village chickens and hybrid birds.

Materials and Methods

Experimental design and birds

The experiment was carried out from January to March. A total of one hundred and fifty 1 to 7 day old eggs were collected from village chickens in Zimbabwe. The eggs weighing 23 ± 1.6 g SD were kept at room temperature for 24 hours and transferred to the incubator. The manufacturer's recommendation for the operation of the incubator was followed. At the 18th day of incubation the eggs were transferred to hatching trays. The chicks started to hatch during the 18th hour of the 21st day of incubation. Eighty chicks were hatched by the 23rd day of incubation. The 23rd day of incubation coincided with the arrival of day old hybrid chicks from Irvine Day Old (Pvt) Ltd. which produces 80 percent of commercial hybrid chicks for the poultry producers in Zimbabwe. Seventy-day-old hybrid chicks (41 ± 2 g SD average body weight) and 70 village chicks (40 ± 1.5 g SD average body weight) were transferred to the floor pens in a deep litter where they were raised under similar conditions.

Housing and Management

The birds were housed in a deep litter shed made from concrete blocks with asbestos roof. The shed was partitioned into two blocks of 20 pens. The pens measuring 15.0 m^2 were partitioned further to 4 m^2 using round cardboard boxes during the first 5 weeks of the experiment. The chicks were divided into groups of 7 birds per group and randomly assigned to 20 pens in a complete randomized block design with 10 pens per treatment.

The mean house temperature was 24.4^o C ± 3.42, with temperature ranges of 18-21, 23-32 and 22-30^{o}C in the morning, at noon, and in the evening, respectively. The relative humidity ranged from 58.3% at noon to 84% in the early morning. During the 21 day brooder phase, natural light was used in the day time, with infra red light from electrical bulbs at night, to maintain a total of 24 h light each day.

Tubular metal hoppers 40 cm in diameter carrying 10 kg of feed were used as feeders. Round plastic basins, 15 cm deep and 25 cm diameter, were filled with clean water, daily, in the morning. Feed troughs were cleaned and filled with feed once per week during weighing.

Diets

Broiler starter feed and water were supplied *ad libitum* to both hybrid and village chickens during the brooder phase up to 28 days. Finisher diet was provided up to 56 days. The feed was formulated to meet the nutritional requirements for poultry as recommended by the Agricultural Research Council (ARC) (1975). The broiler starter feed mixture comprised broiler concentrate and maize meal in a ratio of 1:1.5 respectively, while the finisher diet consisted of a 1:1.8 mixture of broiler concentrate and maize meal. The broiler concentrate supplied by Agrifoods (Pvt) Ltd was balanced for minerals and vitamins and consisted of 90 percent Soya bean meal. The maize meal was a product of yellow maize grain, ground to pass through a 1mm screen. The feed was mechanically mixed at the beginning of the experiment using a horizontal feed mixer (Bentil Engineering (Pvt) Ltd)

Measurements

Daily intake of feed and water were recorded as means of the group by difference of feed offered and feed remaining in the feed hopper, and water offered and water left. Daily temperature and relative humidity were recorded in the morning at 0600h, at noon and in the evening at 1800h. The carcass composition of village and hybrid birds was analysed at the end of the experiment from a sample of representative birds. In addition, the proportion of hatched village eggs was calculated.

Ten chickens from each of the treatments were slaughtered at 9 weeks of age to study the proportions of body components such as dressing percentage, lean, bone, head and neck, heart, lungs, wings, thighs and legs, feet, liver, stomach and crop, length of digestive tract and caecae

Chemical analysis

Feed samples were analysed for dry matter (DM), crude protein (N x 6.25), crude fibre (CF), ether extract, ash, calcium and phosphorus by standard AOAC methods (AOAC, 1990). Metabolisable contents of the diets were calculated from the chemical analysis data using the equation:

$$ME\ (kcal/kg) = 4.26X_1 + 9.5X_2 + 4.23X_3 + 4.23X_4$$

The calculated digestible crude protein, fat, fibre and nitrogen free extractives (g/kg feed) are represented by X_1 through X_4

Statistical analysis

Data on various parameters were subjected to statistical analysis using analysis of variance (ANOVA); General Linear Model procedure of GENSTAT 5 Release 3.2 statistical software.

Economic analyses

Economic analyses were carried out using current feed prices in the Zimbabwe Poultry industry to compare the feeding costs, when feeding village chickens and hybrid chickens, in relation to meat production.

Results

Chemical composition (AOAC, 1990) of the starter and finisher diets is given in Table 1. Table 2 shows the mean daily nutrient intake per bird for the different phases of growth. Calcium to phosphorus ratio was 1.1 Both starter and finisher diets contained slightly more protein than recommended. Twenty per cent crude protein (CP) is recommended for starter phase (0-28 days) while 18% CP is recommended for the finisher phase (29-56 days).

The hybrid chickens consumed significantly more (P<0.01) nutrients than the village chickens at all stages of growth. The rate of nutrient consumption increased with age. Nutrient intake is related to the amount of feed consumed. At 0-28 days the hybrid birds consumed 24 % more feed than the village chickens, while at 35 and 56 days they consumed 31.9 and 39 % more feed respectively (Fig .2).

The village chickens consumed (P<0.01) less water than the hybrid chickens (Fig. 3) with hybrid consuming 46% more water at one week of age, increasing to 62% at 4 weeks and 73% at 8 weeks of age. Importantly, the village chickens also consumed less water per unit of feed than the hybrid birds (Fig. 3)

Live weight and feed conversion ratio (FCR)

Weight gains of village chickens at all phases of growth were significantly lower (P<0.01) than the hybrid chickens (Fig. 1). The hybrid chickens were 48% heavier than the village chickens at one week of age, 69% heavier at 28 days of age, 70% at 35 days and 78% heavier at 56 days of age.

Table 3 shows the feed conversion ratio of the village and hybrid chickens given commercial starter and finisher diets. The hybrid chickens were significantly more efficient (P<0.01) in feed conversion ratio at all phases of growth with a mean FCR of 2.5 ± 0.49 SD compared with FCR of 4.7 ± 1.4 SD in village chickens. Both village and hybrid chickens utilised feed more efficiently during the first 21 days of age than during the finisher phases. At 7-21 days of age, the hybrid chickens utilised feed at 40%-53% more efficiently compared to the village chickens, which were 57%-66% less efficient at 28-56 days of age.

Body composition

The mean weight of carcass components is presented in Table 4, while Figure 4 shows anatomical structures as percentage of carcass weight. Mean dressing out percentage in village and hybrid chickens, on empty body weight (EBW) basis, was 64% and 75% respectively, with carcass yields of 446 and 1539 g at 8 weeks of age. The heart, liver, lungs and wings relative to body weight in village and hybrid chickens grew at a similar rate, whereas the digestive tract, feet head and neck of village chickens grew at a higher rate ($P<0.05$) than in the hybrid chickens. However, the empty body weight of hybrid chickens was significantly higher ($P<0.05$) than in the village chickens. Figure 5 shows bone to lean ratio in village and hybrid chickens. The bone: lean ratio is higher ($P<0.05$) in hybrid (1:4.3) than in the village chickens (1:2.3). Body weight in relation to the length of intestines ratio was higher in the village chickens (1:2) compared to the hybrid chickens (1:1) (Table 4). The nutrient composition of lean and bone in village and hybrid chickens is shown in Table 5. The crude protein content of meat was higher ($P<0.05$) in village chickens (73%) than in the hybrid birds (68%). However, village chickens were leaner (34%EE) than the hybrid (47%EE) at the same stage of growth. There were no differences in the protein and fat content in the bones of village and hybrid chickens.

Mortality and survival rate

Table 3 shows the mortality rate of village and hybrid chickens. Mortality was significantly higher (28%) in village chickens than in hybrid (8%). All the mortality, with the exception of 1% in hybrid chickens, occurred during the first three weeks of age.

Economics of village and hybrid chickens

Table 6 shows the economics of raising village and hybrid chickens under improved feed management. Higher gross margin, net profit and return per dollar invested were obtained from hybrid chickens, compared to village birds. Feed cost per kilogram of live weight was high in village compared to hybrid chickens. However, the differences in return per dollar invested between the village ($1.5) and hybrid ($1.8) chickens were small, although, statistical significance was reached.

Discussion

Maize *(Zea mays)*, constituting 60 – 64 % of the feed formulation, represents the most common energy feedstuff used in poultry diets. The metabolisable energy value (14.2 MJ/kg ME) is considered as a standard with which other energy sources are compared.

Minerals, calcium and phosphorus are important for skeletal growth. The National Research Council (NRC) (1984) recommends 10 g/kg Ca and 4.5 g/kg available phosphorus (AP) for maximum growth and bone formation of young chickens. However, substantial growth was obtained with 1:1 ratio of Ca and AP (Scot, Nesheim and Young, 1982). The efficiency of chickens to produce meat is measured by their rate of weight gain and carcass yield. Undeveloped tropical village chickens are reputed to have low production levels reflected in both low growth rates and carcass yields. In most of these birds it has not been fully established whether this low productivity is due to their genetic make up or to poor management.

In the present study village chickens:

- Had low growth rates reaching slaughter weights of 600 g at 8 weeks and 1500 g at 15 weeks, compared to 1950 g and 4500 g for hybrid chickens respectively
- Had a poorer feed conversion ratio than hybrid chickens. The cost of feed per kilogram of live-weight gain was 44% more in village chickens
- Produced low carcass yield in the form of dressing percentage and weight of offal. The hybrid birds produced high meat yields in the form of dressing percentage and empty body weight
- Produced carcasses of good quality, as reflected by high protein (73.2%) and low flat (34.1%). The carcasses of hybrid chickens had a high fat content (47%)
- Had a high mortality rate (28%) compared to hybrid birds (8%)
- Were less profitable than hybrid chickens, but still afforded a positive return per dollar invested ($1.5). Hybrid birds showed a $1.8 return per dollar invested

The low growth rate of village birds indicates that they had a low response to improved feeding management systems. However, live weights of indigenous chickens in Malaysia under intensive systems of management showed lower live weights compared to those reported in the current study (Jalaludin *et.al,* 1985). These weighed 380 g at 8 weeks and 1170 g at 15 weeks. This could be attributed to the level of protein in the feed (Yeong, 1992). Village chickens raised intensively showed a better growth rate at 16 weeks of age when fed at a higher crude protein level: 1184 g live weight at 18% crude protein, 1254 g at 20% and 1409 at 23 % crude protein levels (Yeong, 1992). The crude protein level in the current study was 21%. The increase in body weight of hybrid appeared to be associated with an increase in water and feed intake (Marks, 1979; Siegel and Wisman, 1966). Accompanying their low body weight performance, village chickens had low carcass yield in the form of low dressing percentage and weight of offal. The low rate of growth of most internal organs indicates that their proportion in the slaughter weight will decrease, whereas the high rate of mesenteric fat increases with increased body weight.

Although the village chickens in the current study afforded a low carcass yield, Teketel (1986) found higher dressing percentage in indigenous chickens raised under station conditions compared with White Leghorns. The mean carcass weight of indigenous birds was 558g, a figure significantly lower than the 875g for White Leghorns at 12 weeks old. Indigenous chickens in this study were heavier than those reported above, weighing 600g at 8 weeks old.

In the current study, the cost of feed per kilogram of live-weight gain was 44% more in village chickens than in the hybrids. This difference is consistent with the low feed conversion ratio observed in village chickens. The hybrid birds produced high lean and low bone content. The bone content of the carcass is an important factor in determining meat quality. It has been shown that the proportion of bone in good carcasses does not exceed 14% (Hill, 1988). Hybrid carcasses in this study showed 13.8% bone, which is within the above range, while that of village chickens was 19%. The proportion of bone depends on the degree of finish of the carcass, the higher the fat percentage the lower bone content. However, village chickens produced carcasses with a low fat content. (The dietary concerns related to high fat in western diets may not be an issue in rural Zimbabwe, where animal fat is an important source of energy.) It has been observed that as chickens age the relative amount of energy required for growth declines (Marks 1979), the excess energy consumed may result in increased daily fat accretion (Robbins and Ballew, 1984). There is evidence to suggest that modern rapid growing hybrid broiler lack appetite regulatory mechanisms (Lacy, Van Krey and Denbow, 1983), suggesting their inability to adjust energy consumption for changes in the relative requirements for growth. The eviscerated carcass yield of village chickens (63%) in the current study was within the range 50% - 71% reported for indigenous chickens in Nigeria and Senegal (Joseph *et.al.* 1992).

All the mortality in village chickens occurred during the first 3 weeks of age. Laboratory investigations from post mortem of the dead chickens confirmed an outbreak of Bronchitis Infectious Respiratory Disease (BIRD). Village chickens were more susceptible to the disease. It was speculated that the hybrid chickens could have acquired some immunity through the egg from their parents, since the parent stocks were selected and bred for growth and against some of the common diseases. Severe rearing losses, with high mortality in young indigenous chickens have been reported under traditional management systems to reach up to 50% up to 8 weeks in Burkina Faso (Wilson, 1986) and 68% up to 6 weeks in Nigeria (Ologhobo, 1992). Brannange and Pearson (1990) observed high incidences of mortality among indigenous birds when kept under confinement. This was attributed to the fact that indigenous birds are not accustomed to confinement and that diseases which are important under confined conditions, may have much more serious effect on local than exotic birds.

Gross margin analysis was employed to evaluate the economics of feeding commercial diets to village in comparison with the hybrid chickens. It was more profitable to feed the commercial diets to hybrid chickens than to village chickens. Both gross margin and net profit from village chickens were positive, demonstrating that relative profit could still be realized from the improved feeding management of village chickens.

Conclusions

This study has shown that under improved feed management, the performance of village chickens is low in terms of growth, late sexual maturity and high rearing mortality This can be attributed in part to the lack of genetic improvement through selection or crossbreeding. However, village chickens have valuable traits (it is important to provide specific examples here) that are not found in hybrids and need to be fully characterized. Village chickens were less profitable providing a net profit of Z$58, as opposed to Z$184 afforded by the hybrid birds. However, they still afforded a positive return per dollar invested of Z$1.5, compared to a return of Z$1.8, afforded by the hybrid birds. There is considerable scope to investigate the potential of village chickens under traditional low input/low output farming systems. The low feed conversion ratio in village chickens and the slow growth rates to maturity suggests potential to improve nutrition through use of locally available least cost feed resources.

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Table 1. Ingredient % and chemical composition (g/kg DM) of the diets fed to village and hybrid chickens in the experiment

	Concentrate diets	
Ingredient (%)	Starter diet	Finisher diet
Maize	60	64
Broiler concentrate	40	36
	Chemical composition (g/kg DM)	
Crude Protein (CP)	224.0	210.0
Crude Fibre (CF)	30.0	37.4
Ether Extract (EE)	28.0	28.4
Ca	9.4	11.2
Available P	8.8	8.9
NaCl	2.2	2.5
ME (MJ/kg)	12.3	12.5
Methionine (%)	0.69	0.68
Lysine (%)	1.16	1.14

Table 2. Mean daily nutrient intake (g/bird/d) of village and hybrid chickens for different phases of growth, when fed commercial poultry diets *ad libitun*

Nutrient and Phase of growth	Village chickens	Hybrid chickens	s.e.m.	P value
CP				
21 days	8.2	12.7	0.28	0.01
28 days	9.7	12.8	0.48	0.01
35 days	14	20.6	0.77	0.01
56 days	17.4	33.8	1.52	0.01
ME (MJ)				
21 days	0.45	0.71	0.16	0.01
28 days	0.45	0.71	0.22	0.01
35 days	0.87	1.3	0.48	0.01
56 days	1.08	2.1	0.71	0.01
CF				
21 days	1.1	1.7	0.38	0.01
28 days	1.5	2.4	0.74	0.01
35 days	2.7	3.9	0.84	0.01
56 days	3.3	6.4	0.22	0.01
Ca				
21 days	0.05	0.07	0.02	0.01
28 days	0.06	0.08	0.02	0.01
35 days	0.09	0.12	0.05	0.01
56 days	0.11	0.21	0.06	0.01
Available P				
21 days	0.05	0.08	0.02	0.01
28 days	0.06	0.09	0.03	0.01
35 days	0.09	0.14	0.07	0.01
56 days	0.11	0.22	0.09	0.01

Table 3. Mean feed conversion ratio, FCR (g feed per kg live weight) and mortality rate (%) of village and hybrid chickens

	FCR				Mortality rate (%)	
Age (weeks)	Village	Hybrid	s.e.m	P > F	Village	Hybrid
1-3	3.0[a]	1.6[b]	0.09	0.001	28	7
4-8	5.5[a]	2.6[b]	0.57	0.001	Nil	Nil
9-12	4.9[a]	2.7[b]	0.33	0.001	Nil	Nil
13-16	5.4[a]	3.2[b]	0.26	0.001	Nil	1
Mean	4.7[a]	2.5[b]	0.18	0.001	28	8

[a b] Means in the same row with different superscripts differ significantly ($P < 0.05$)

Table 4. Mean weight of carcass components of village and hybrid chickens fed commercial diets *ad libitum*

	Village chickens	Hybrid chickens	s.e.m
Slaughter age (days)	63	63	
Plucked dead weight (g)	700[a]	2061.5[b]	1.02
Empty body weight (g)	231[a]	914.2[b]	1.54
Dressing Out (%)	63[a]	74.7[b]	0.9
Bone (g)	133[a]	284[b]	2.5
Lean (g)	310[a]	1222[b]	3.6
Head and neck (g)	71.5[a]	152.6[b]	0.65
Heart (g)	6.5[a]	11.6[b]	0.19
Lungs (g)	7.1[a]	17.4[b]	0.21
Liver, stomach, crop (g)	23.8[a]	64.7[b]	0.8
Digestive tract (g)	51[a]	110[b]	0.53
Wings (g)	66[a]	176[b]	0.97
Thighs and legs (g)	149[a]	449[b]	1.3
Feet (g)	37.7[a]	75.3[b]	0.24
Length of intestines (cm)	1264[a]	1738[b]	3.2
Length of caeca (cm)	109.6[a]	193[b]	1.2

[ab] Means on the same line with different superscripts differ significantly ($P<0.05$)

Table 5. Nutrient composition (percent) of lean and bone of carcasses in village and hybrid chickens given commercial diet

	DM	CP	Fat (EE)	Ash
Lean				
Village chickens	97.9[a]	73.2[a]	34.1[a]	9.9[a]
Hybrid chickens	97.8[a]	69.7[b]	47.0[b]	6.7[a]
s.e.m	1.23	2.84	3.91	2.13
Bone				
Village chickens	98.5[a]	25.4[a]	27.2[a]	2.6[a]
Hybrid chickens	98.2[a]	25.10[a]	27.2[a]	3.5[b]
s.e.m	0.31	0.22	0.09	1.24

[a b] Means in the same column with different superscripts differ significantly (P < 0.05)

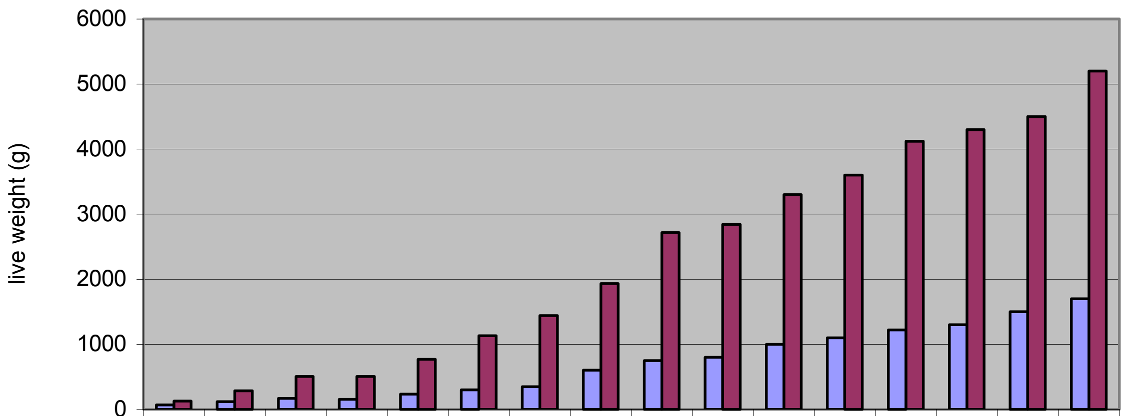
Table 6. The economics of feeding village and hybrid chickens on commercial diets: Mean values

	Village	Hybrid	s.e.m	P > F
Age (weeks)	8	8		
Feed consumption (kg)	2.72[a]	4.94[b]	2.2	0.001
Live weight (g)	600 [a]	1934 [b]	39.3	0.001
Plucked dead weight (g) (carcass weight?)	550 [a]	1280 [b]	30.8	0.001
[c]Gross Income (Z$)*	220 [a]	512 [b]	3.4	0.001
[d]Total Variable Costs, TVC (Z$)	147 [a]	286 [b]	0.53	0.001
Price of concentrate (Z$)*				
Price of maize (Z$)*				
[e]Gross Margin, GM (Z$)*	73 [a]	211 [b]	0.29	0.001
Feed cost/kg live weight (Z$)*	229 [a]	129 [b]	0.48	0.001
Net profit (Z$)*	58 [a]	184 [b]	0.51	0.001
Return per $ invested	1.5 [a]	1.8 [a]	0.13	0.001

[ab] Means in the same row with different superscripts differ significantly P < 0.01
** Rounded to the nearest dollar
[c]Gross Income = X*Y
[d]TVC Total variable costs = the costs directly related to chicken production (needs to be more clearly defined. What causes the difference in TVC between village & hybrid birds? Is it the difference in the cost of day-old chicks?)
[e]Gross Margin = (X*Y) – (TVC)
Net Profit = (X*Y) – (TVC) – TVC*0.1)
Feed cost/kg Live weight = (C)/Live weight
Where: X = Carcass weight (kg)
Y = Price of carcass $/kg (needs to be described)
C = Cost of feed = (Feed consumed (kg) * Price of feed ($/kg)
Price of feed = ($101/kg for concentrate and $17/kg for maize)

Overhead costs (Often 10 % of TVC) = General operating costs of running project (?)

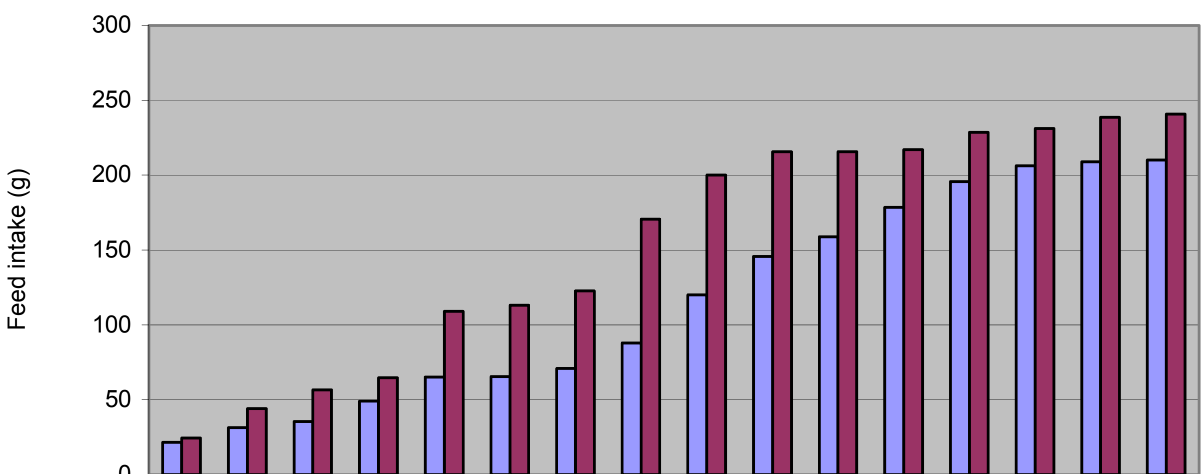
Fig. 1 Mean live weight (g/bird/week) of village and hybrid chickens given a commercial diet



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Village	66	117	169	154	230	299	348	600	750	800	1000	1100	1220	1300	1500	1700
Hybrid	126	286	507	503	768	1129	1440	1934	2716	2840	3300	3600	4120	4300	4500	5200

Age in weeks

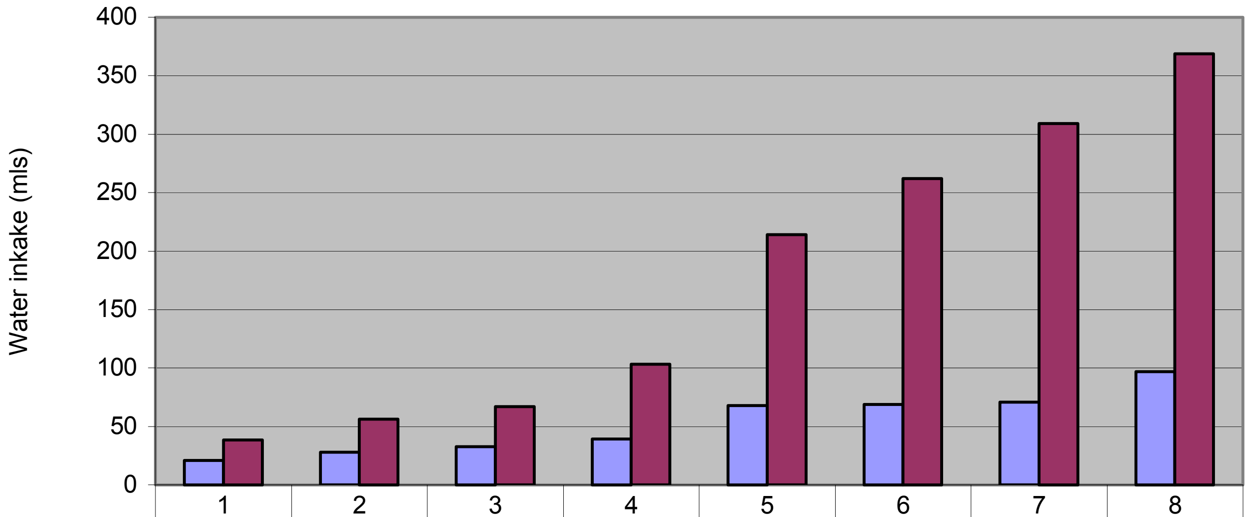
Fig. 2 Mean feed intake (g/bird/d) of village and hybrid chickens given a commercial diet



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Village	21.5	31.5	35.5	49.2	65.2	65.5	70.9	87.9	120	145.7	158.8	178.5	195.7	206.4	208.9	210.2
Hybrid	24.5	44.2	56.5	64.8	109.1	113.2	122.8	170.7	200	215.6	215.7	217.1	228.5	231.2	238.7	240.8

Age in weeks

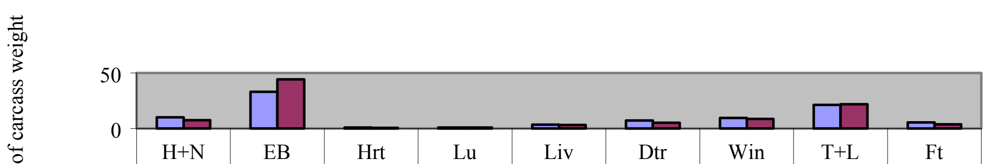
Fig. 3 Mean water intake (ml/bird/d) of village and hybrid chickens given a commercial diet



	1	2	3	4	5	6	7	8
Village	20.9	27.8	32.8	39.4	68	69	71	97
Hybrid	38.5	56.1	67	103.2	214	262	309	369

Age in weeks

Fig.4 Mean percentage of body weight of anatomical structures of village and hybrid chickens given a commercial diet



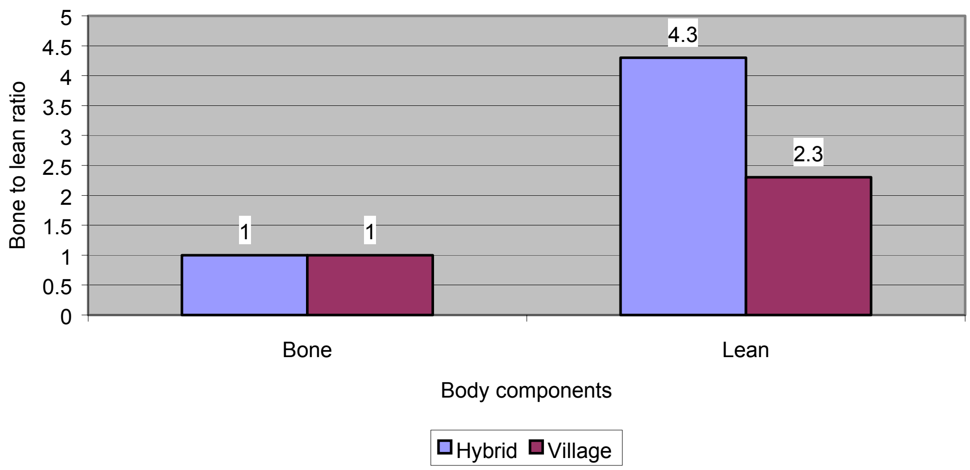
	H+N	EB	Hrt	Lu	Liv	Dtr	Win	T+L	Ft
Village	10.2	33	0.9	1	3.4	7.3	9.4	21.3	5.4
Hybrid	7.4	44.3	0.6	0.8	3.1	5.3	8.5	21.7	3.6

Body components

<u>Code</u>

Head and neck	H+N	Digestive tract	Dtr	Lungs	Lun
Empty body	EB	Wings	Win	Liver, stomach, crop	Liv
Heart	Hrt	Thighs and legs	T+L	Feet	Ft

Fig. 5 Ratio of bone to lean in village and hybrid chichens carcasses given commercial diet (This table is probably unnecessary. Are you simply saying that the bone:lean ratio is 1:4.3 for hybrid birds & 1:2.3 for indigenous birds?)



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