

Effects of Local Feedstuff Supplementation on Zootechnic Performances and Nutritional Status of Village Chickens during the End of the Rainy Season in Burkina Faso

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Key words

Chicken – Cockerel – Supplementary feeding – Poultry farming – Burkina Faso.

Summary

The effect of local feedstuff supplementation during the end of the rainy season, from September to October, on performances of village chicken cockerels was investigated using four treatments (T1 to T4) and four blocks. In T1, birds were allowed to find their daily ration by scavenging only. In T2, T3 and T4, birds received after scavenging supplementation with red sorghum seeds, artisanal sorghum beer by-products or the combination of both, respectively. Four household compounds, in a village in the central region of Burkina Faso, were assigned as blocks. The results suggested that during the end of the rainy season, scavenging enabled an average weight gain of 5.9 g/d in the cockerels. No clear effect of supplementation on performances was observed. When scavenging feedstuffs were available, the local beer by-product or the association red sorghum/artisanal beer by-product gave higher body weight gains. At the end of the experiment, three to four birds per treatment and per block were slaughtered after scavenging, and crop contents were sun-dried and examined physically. The major components of scavenging feedstuffs during the period of the study were cereals (55%), and worms or insects (22%). This study provides some indications for strategic feeding of village chickens during the end of the rainy season.

INTRODUCTION

A number of authors (2, 4, 12) stated that indigenous poultry in tropical rural areas mainly find their daily diet by scavenging around households. However, the scavenging feed resource base is limited and varies with seasonal circumstances such as rainfall, cultivation, harvest and crop processing (6). In general, farmers supplement birds by giving them household wastes, or cereal by-products, generally in the morning or late in the afternoon (1). In

the rainy season, many feedstuffs for scavenging are available, such as insects, worms, cereal seeds, vegetables (14). However, according to some other authors (12), the most available feeds for scavenging have a relatively low energy concentration since they contain high levels of crude fiber. Then, the hypothesis that can be stated is that even in the rainy season, particularly at the end of the rainy season when more available feedstuffs are present, supplementation with some local feedstuffs may improve village chicken growth.

In the case of the central region of Burkina Faso, farmers use in general red sorghum seeds as supplement. Then, it was investigated in this study whether supplementation with red sorghum and/or artisanal beer by-product could be helpful in improving performances during the end of the rainy season (September to October). The current study aimed at identifying the effect of supplementation during the end of the rainy season on village chicken growth and slaughter performances by evaluating four types of supplementations.

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■ MATERIALS AND METHODS

Birds, housing and management

A total of 160 cockerels of village chickens with a mean body weight of 756.3 ± 12.6 g were purchased at the local markets for the trial. Housing consisted of pens with a surface area of 1 m^2 per group of 10 birds.

The birds were vaccinated with ITA New as prophylaxis against newcastle disease and received the *vermifuge polyvalent volailles* (VPV) 100 against internal parasites at the beginning of the trial; they were left to adapt to their pens and treatments for a week.

Scavenging birds were free ranged early in the morning (around 6 a.m.) and enclosed in their pens late in the evening (around 6 p.m.). Birds which received supplements were captured in the afternoon after scavenging and received supplementation in their respective pens. Supplementation was given ad libitum. Two types of local feedstuffs were used as supplements: (1) red sorghum seeds, and (2) the artisanal sorghum beer by-product. Household compounds were the source for scavenging feedstuffs. Birds had free access to water throughout the day.

The study was carried out under village conditions during the end of the rainy season in the village of Yambassé, located in the central region of Burkina Faso. This period covers two months, September and October, when crop products are ready for harvesting. Daily capture of the birds and distribution of the different treatments in each household compound were performed with the help of the household chief and some members of his family.

Design of the experiment

Four types of feeding were assigned to treatments T1 to T4:

- T1, scavenging only. Cockerels found their feed around the household compounds;
- T2, scavenging + ad libitum supplementation with red sorghum seeds;
- T3, scavenging + ad libitum supplementation with artisanal sorghum beer by-product;
- T4, scavenging + ad libitum supplementation with both feedstuffs given separately in two troughs.

Four household compounds were used as blocks. A set of five to eight birds were used to receive each treatment at each household. At the end of the trial, three to four birds per treatment and block were slaughtered in the morning at around 9 a.m. This time was chosen based on the observations by Faltwell and Fox in 1978 (14). They indicated that birds fill their crop in a four-hour cycle of eating.

Data collection

Collection of data started after one week of adaptation to the diet and to the pens in each block. The parameters measured were body weight gain, supplement consumption, dressing, carcass weight and crop contents. For that, live body weights of individual chickens and feed refusals for each experimental unit were weighed weekly. At slaughter, the gut was removed and the carcass, head and legs of each cockerel were weighed.

Crop contents were sun-dried and dry crop contents were visually examined and weighed in order to assess feedstuffs and their different proportions in the crop. With regard to the statement that, for empirical experiments (3), responses in growth should be measured over a short time period, the present experiment was carried out in four weeks.

Cost benefit of the supplementation was assessed on the basis of feed cost, purchased price and prophylaxis cost. In the market during the period of the study, the red sorghum price was 100 FCFA/kg and the local beer by-product was 10 FCFA/kg. The village chicken sale price was calculated on the basis of the regression equation previously published (8) between the village chicken body weight and the price (sale price = $175.4 + 0.7$ body weight [g], $r = 0.6$).

Statistical analyses

SPSS was used for data analysis considering individual bird data. The differences between treatments, blocks or interactions were studied by ANOVA by the general linear model. The model equation (13) used to analyze the parameters (body weight gain, dressing, carcass weight...) was:

$y_{ijk} = u + a_i + b_j + aib_j + e_{ijk}$, with a_i the effect of the treatment (type of feeding), b_j the effect of the block (household), aib_j the effect of the interaction, e_{ijk} the error term, $E(e_{ijk}) = 0$. The significance level was 0.05. Separation of means was done by the pair-wise multiple comparison tests, the least significant difference (LSD).

■ RESULTS

Effect of type of feeding (treatment) and availability of scavenging feedstuffs (block or household) on village chicken cockerels' weight gain

Results on cockerel weight gains per type of feeding (treatments) and scavenging conditions (household compound or block) during 28 days are presented in Table I. Appreciation of the main effects indicated that there were no significant differences ($P < 0.05$) between treatments for four weeks in cockerel body weight gains, whereas between blocks significant differences were observed. Blocks 1 and 4 had higher ($P < 0.05$) weight gains (202.9 ± 19.2 g and 222.5 ± 27.3 g, respectively) than blocks 2 and 3. Nevertheless, a tendency of higher weight gain was observed with the supplementation by the artisanal beer by-product T3 (184.8 ± 27.9 g and daily weight gain [ADG] of 6.6 g/d). The slowest growers were the birds that could choose between red sorghum and local beer by-product (T4) with a weight gain of 155.2 ± 42.9 g and an ADG of 5.5 g/d.

The effect of treatments (Table I) within the block (effect of the interaction of scavenging conditions [block] and the type of feeding [treatment]) showed different tendencies. Hence, when the availability of the scavenging feedstuffs was large (B1), supplementation with red sorghum, artisanal beer by-product or both these feedstuffs did not allow cockerels to gain more ($P < 0.05$) weight than scavenging alone. The combination (T4) even reduced significantly the body weight. When there was scarcity of scavenging feedstuffs (B2 evidenced by the lower weight gain of T1), supplementation with red sorghum (T2) resulted in the highest weight gains ($P < 0.05$), but the combination (T4) did not promote the same result. When scavenging feedstuffs were relatively sufficient but in such a way that supplementation could have some effects (B4), the use of both feedstuffs (T4; red sorghum and artisanal beer by-product) gave better ($P < 0.05$) results, followed by the use of the local beer by-product only (T3).

Intake of feedstuff supplements by village chicken cockerels

Supplemental intakes of red sorghum and artisanal beer by-product, according to the treatments and the blocks, are presented in Table II. Significant differences ($p < 0.05$) of supplement

intakes were observed between treatments with 43.5 g/day/bird for the red sorghum, 31.0 g/d/bird for the association red sorghum/artisanal beer by-product and 5.9 g/d/bird for the local beer by product. When analyzed by block, only intake in block 2 appeared to be higher than intakes in the other blocks with 30.8 g/d vs 24 to 27 g/d of supplement intakes. Within the block, higher intakes were in B2 for the red sorghum (T2), B4 for the local beer by-product (T3), and B1 for the association red sorghum and local beer by-product (T4).

Effect of type of feeding on slaughter data of village chicken cockerels

Dressing of cockerels were 61.0, 64.3, 65.5 and 61.5% for T1, T2, T3 and T4, respectively. Carcass weights varied from 370 to 690 g. No significant differences ($P < 0.05$) were observed between treatments or blocks for carcass weight and dressing percentage. Within the block, some tendencies could be distinguished. Hence, in B1, T1 gave the highest carcass weight (640 g), whereas in B2, B3 and B4, T2 (634 g), T3 (690 g) and T3 (613 g) gave the best performances, respectively. In terms of dressing percentage, the effect of the treatment within the block did not follow the tendency of the carcass weight. Hence, in B1, B2, B3, and B4, the highest dressings were observed with T3, T2, T4 and T3, respectively.

Crop contents of village chicken cockerels

The diversity of scavenging feedstuffs was observed by examination of crop contents. Crops contained sun-dried matter whose weight varied from 8.9 to 12.7 g with a mean of 9.9 g. Five types of feedstuffs could be distinguished: insects/worms; cereals; stones, egg shells and bones; grass; and legume seeds. Cereals (55%) and worm/insects (22%) represented the most available scavenging feedstuffs for village chickens during the period of the study (Table III). In absolute numbers, cereals, insects/worms, stones, egg shells and bones, grass, legume seeds and unspecified feedstuffs, which were probably household waste, represented 5.5 g, 2.2 g, 0.44 g, 0.1 g, 0.32 g and 1.5 g in the crop of village chicken cockerel, respectively.

According to the household, no significant differences were observed for sun-dried matter of crop content weights between blocks. However, the nature and percentage of the feedstuffs in the crop varied according to the block.

Economical assessment of the supplementation

To appreciate the economical effect of the supplements used, an economical assessment taking into account the feed cost, purchased price and prophylaxis cost is presented in Table IV. Costs of labor and housing were not taken into account as

Table I

Body weight gain of village chicken cockerels (mean \pm SE) according to the type of feeding (treatments) and the household (blocks) during 28 days

Blocks	Treatments (g)				Overall (g)
	T1	T2	T3	T4	
B1	233.3 \pm 30.1 ^a	221.9 \pm 24.7 ^a	209.4 \pm 17.3 ^a	146.9 \pm 20.3 ^b	202.9 \pm 19.2 ^{ab}
B2	87.5 \pm 18.3 ^b	212.5 \pm 6.7 ^a	125.0 \pm 24 ^b	106.3 \pm 14.8 ^b	132.8 \pm 27.6 ^{bc}
B3	128.6 \pm 25.3 ^{ab}	95.8 \pm 16.4 ^b	155.0 \pm 13.8 ^a	89.3 \pm 18.8 ^b	117.8 \pm 15.3 ^c
B4	208.3 \pm 12.6 ^b	153.1 \pm 17.3 ^c	250.0 \pm 23.7 ^{ba}	278.6 \pm 17.9 ^a	222.5 \pm 27.3 ^a
Overall	164.4 \pm 34 ^a	170.8 \pm 29.3 ^a	184.8 \pm 27.9 ^a	155.2 \pm 42.9 ^a	

T1 = scavenging only; T2 = scavenging + red sorghum; T3 = scavenging + artisanal beer by-product; T4 = scavenging + red sorghum + artisanal beer by-product

For the interaction, mean values on the same row with different superscripts are significantly different at $P < 0.05$. For the overalls, mean values on the same column or on the same row with different superscripts are significantly different at $P < 0.05$

Table II

Intake of supplement sun-dried matter (mean \pm SE) by village chicken cockerels according to the type of feeding (treatments) and the household (blocks)

Blocks	Treatments (g)				Overall (g)
	T1	T2	T3	T4	
B1	–	43.0 \pm 2.5	4.1 \pm 2.3	33.4 \pm 2.2	26.8 \pm 1.4 ^a
B2	–	53.8 \pm 2.2	5.9 \pm 2.5	32.8 \pm 2.2	30.8 \pm 1.3 ^b
B3	–	41.7 \pm 1.7	5.8 \pm 1.7	26.7 \pm 1.7	24.7 \pm 1.0 ^a
B4	–	35.3 \pm 1.7	7.7 \pm 1.8	30.9 \pm 1.7	24.6 \pm 1.0 ^a
Overall	–	43.4 \pm 1.3 ^a	5.9 \pm 1.1 ^b	31.0 \pm 1.0 ^c	

T1 = scavenging only; T2 = scavenging + red sorghum; T3 = scavenging + artisanal beer by-product; T4 = scavenging + red sorghum + artisanal beer by-product

For the overalls, mean values in the same row or in the same column with different superscripts are significantly different at $P < 0.05$

Table III

Variability of feedstuffs found in chicken crops expressed in percentages of crop content air-dried matter per block

Feedstuffs in crop	Household compounds				Overall
	Block 1	Block 2	Block 3	Block 4	
Red sorghum	23.4	46.6	48.1	11.7	35.6
Worms	6	31.1	16.6	11.7	18.8
Maize	0.8	7.8	6.5	34	11.9
Rice	30.5	1.1	0.9	6.4	6
Insects	7	2.2	3.7	0	3
Stones	14.1	1.1	0.9	2.1	3
Groundnut seeds	0	0	1.8	4.2	2
Millet	0.16	0.1	0	0	1
Bones	0	0	0	4.2	1
Herb leaves	0.8	2.2	2.7	0	1
Herb seeds	3.1	0	0.2	0	0.5
Bean seeds	0	0	0.1	2.1	0.4
Egg shells	0	0	0.9	0.3	0.4
Groundnut shells	0	0	0	1.0	0.3
Unspecified	14.1	7.8	17.2	22.3	14.9
Overall	100	100	100	100	100

Table IV

Economical assessment of the supplementation

	Treatments			
	T1	T2	T3	T4
Starting weight (g)	792.7	726	770.4	736.1
Purchased price (FCFSA) (A)	730	685	715	690
Weight (g) at week 4	957.1	896.9	955.2	891.3
Gross income (FCFA)/bird (B)	845	805	845	800
Supplement cost (FCFA) (C)	0	120	5	75
Prophylaxis cost (FCFA) (D)	30	30	30	30
Gross margin (FCFA)/bird (B - [A + C + D])	85 ^a	-30 ^c	95 ^a	5 ^b

T1 = scavenging only; T2 = scavenging + red sorghum; T3 = scavenging + artisanal beer by-product; T4 = scavenging + red sorghum + artisanal beer by-product

Means of gross margin with different superscripts are significantly different at $P < 0.05$

they could vary considerably from one farmer to another. Results indicated higher gross margins with treatments T3 and T1, and no significant difference ($P < 0.05$) was observed between these two treatments. Furthermore, it appeared that the use of red sorghum (T2 and T4) as supplement lowered the gross margin.

DISCUSSION

The current study suggested that the effects of supplementation might be dependent on the availability of scavenging feedstuffs. In all scavenging conditions (B1, B2, B3, B4), a positive weight gain was found when birds were fed on scavenging feedstuffs only. Then, it can be stated that at the end of the rainy season, scavenging feedstuffs are enough to support village chicken body weight gains. These observations are consistent with a previous assertion (14) indicating that in the rainy season an increase of available proteins (insects, worms) and succulent vegetables prevent undernutrition of village poultry.

There were highly significant differences between blocks and this may indicate that the quantity and nutritive value of available scavenging feedstuffs varied widely between household compounds. Thus, the availability of scavenging feedstuffs had a high influence on the effect of supplementation of village chickens and had to be taken into account for the choice of feedstuffs to be used as supplements and the period of supplementation.

Sorghum has a mean content of 8.9% crude protein, 2400 kcal/kg calories of metabolizable energy, 2.3% crude fiber, 0.003% calcium, and 0.28% phosphorus (9). It is thus a valuable feed supplement. As a by-product of red sorghum, the artisanal beer by-product has a lower nutritive value (less starch) than the red sorghum itself.

In general, daily weight gains were low in this study (5.5 g/d to 6.6 g/d). This may be due to the inadequacy of the free-range daily diet, the low nutritive value of the supplements used in the study, or the low genetic potential of village chickens; indigenous chickens are known to have some disadvantages such as slow growth, poor egg production and late sexual maturity (4, 5, 10).

Body weight gains were not significantly different ($P > 0.05$) between treatments, which was in contradiction with some studies (7), which stated that supplemental feed, especially protein sources, increased the productivity of scavenging and semiscavenging chicken. The lack of effect of supplementation suggested that in the conditions of this experiment the availability of feed to scavenging chicken was not the main limiting factor of the performance. However, in absolute value there was a higher weight gain with the supplementation of artisanal beer by-product (T3) and a lower weight gain with the supplementation of both feedstuffs (T4). It should be noted that there was an interaction with households which resulted in treatments supporting the highest growth being never the same (T1 in B1, T2 in B2, T3 in B4 and T4 in B4). Moreover, the animal performance was not related to the quantity of supplement DM consumed by the animals. Some feed consumption results were difficult to explain, e.g. consumption was always higher in T2 than in T4. Intakes of red sorghum (24.6 g/d in T4 vs 42.7 g/d in T2) and artisanal beer by-product (5.4 g/d vs 6.7 g/d in T3) were both lower in T4 than in T2 and T3, respectively. Palatability of the beer by-product could have affected feed intake negatively. This might be due to the relatively high crude fiber content in the artisanal sorghum beer by-product and its presentation (flour), which might have reduced feed intake. According to other studies (11), about 35 g of grain supplement per hen per day are necessary for local chickens in the free-range system. The range of intake of the red sorghum (35 to

53.8 g) observed in the present study was consistent with this figure and should then have promoted a satisfactory growth.

Analyses of crop contents in this study showed that cereals remained the main available feedstuffs (55%) for village chickens during the period of study. The main cereal was sorghum seed, which represented 66% of the cereals present in the crop. This observation was related to the fact that households in this village grew mainly sorghum (essentially red sorghum) around household compounds. So village chickens had more easily access to sorghum, as a source of energy in their daily diet, than to other seeds. The other feedstuffs seemed negligible in village chickens daily diets. A previous study (14) also showed high percentages of seeds in village chicken crops (about 30.9%) during the rainy season in the central region of Ethiopia.

The economical assessment in relation to the treatment showed a negative gross margin with the use of sorghum as supplement (T2). A better-expected gross margin (95 FCFA/bird) was observed with the use of the artisanal beer by-product due to its low cost, but it was not significantly different from the control. According to these results, it can be suggested that in the present conditions supplementing village chickens with artisanal beer by-product or sorghum is not appropriate.

■ CONCLUSION

The current study does not indicate the necessity to supplement village chickens at the end of the rainy season. However, it can be anticipated that in husbandry conditions or in the season when scavenging feedstuffs are less available, supplementation should be more efficient, improving significantly village chicken weight gains. Furthermore, the cost/benefit study of the supplementation showed the need to use low cost feedstuffs for village chicken supplementation. For that purpose, some by-products such as local beer by-products seem more suited for supplementation than cereals. This should be studied at periods when supplementation has a significant effect. But in that case, proteins might be the main limiting factor for scavenging birds. In further investigations, local available proteins from by-products should be identified, as well as their appropriate period of supplementation. Factors that influence palatability of supplementation should be studied as well.

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Résumé

Kondombo S.R., Kwakkel R.P., Nianogo A.J., Slingerland M.
Effet de la complémentation avec des aliments locaux sur les performances zootéchniques et le statut nutritionnel des poulets villageois durant la fin de la saison pluvieuse au Burkina Faso

L'effet de la complémentation d'aliments locaux sur les performances des poulets villageois mâles a été étudié en fin de saison pluvieuse, de septembre à octobre. Un dispositif avec quatre traitements (T1 à T4) et quatre blocs a été utilisé. Dans le traitement T1, les coquelets ont recherché eux-mêmes leur ration quotidienne par la divagation. Dans les traitements T2, T3, et T4, les coquelets ont reçu, après la divagation, respectivement une complémentation de grains de sorgho rouge, de drèche de bière locale ou de ces deux aliments. Quatre habitations dans un village de la région centrale du Burkina Faso ont été utilisées comme blocs. Les résultats suggèrent que, durant la fin de la saison pluvieuse, la divagation a permis aux coquelets d'obtenir un gain de poids moyen quotidien de 5,9 g. L'effet de la supplémentation sur les performances n'a pas été significatif. Dans les cas de la disponibilité des aliments par divagation, la drèche de *dolo* ou l'association sorgho rouge/drèche de *dolo* ont permis des gains de poids plus importants. A la fin de l'expérience, trois à quatre coquelets par traitement et par bloc ont été sacrifiés après divagation et les contenus de leurs jabots ont été séchés au soleil et examinés physiquement. Les aliments obtenus de la divagation durant la période de fin de saison pluvieuse ont été essentiellement constitués de céréales (55 p. 100) et d'insectes ou de vers de terre (22 p. 100). L'étude donne des indications pour une stratégie d'alimentation des poulets villageois pendant la fin de la saison pluvieuse.

Mots-clés : Poulet – Coquelet – Alimentation complémentaire – Elevage de volailles – Burkina Faso.

Resumen

Kondombo S.R., Kwakkel R.P., Nianogo A.J., Slingerland M.
Efectos del suplemento alimenticio local sobre los rendimientos zootécnicos y el estado nutricional de pollos de pueblo durante el fin de la estación lluviosa en Burkina Faso

Se investigó el efecto del suplemento alimenticio local durante el fin de la estación lluviosa, de septiembre a octubre, sobre los rendimientos de los gallos jóvenes de pueblo, mediante cuatro tratamientos (T1 a T4) y cuatro bloques. En T1, las aves las aves buscaban su ración diaria únicamente en carroñas. En T2, T3 y T4, las aves recibieron después de la búsqueda en carroñas un suplemento con semillas de sorgo rojo, sub productos artesanales de la cerveza de sorgo o una combinación de ambos, respectivamente. Como bloques se asignaron cuatro núcleos familiares en un pueblo en la región central de Burkina Faso. Los resultados sugieren que durante el fin de la estación lluviosa, la búsqueda en carroña permitió una ganancia de peso promedio de 5,9 g/d en los gallos jóvenes. No se observó ningún efecto claro del suplemento sobre los rendimientos. Cuando la carroña era accesible, el sub producto de cerveza local o la asociación sorgo rojo/sub producto artesanal de la cerveza produjo mayores ganancias de peso. Al final del experimento, tres a cuatro aves por tratamiento y por bloque fueron sacrificadas después del periodo de carroña y los contenidos de alimento secados al sol y examinados físicamente. La mayor parte de los componentes de la búsqueda de carroña durante el periodo del estudio fueron cereales (55%) y gusanos o insectos (22%). El presente estudio provee algunas indicaciones para la alimentación estratégica de los pollos de pueblo durante el fin de la estación seca.

Palabras clave: Pollo – Gallito – Alimentación complementaria – Cría de aves de corral – Burkina Faso.