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THE EFFECTS OF CONCENTRATE TO GRASS HAY RATIO ON THE FEEDLOT PERFORMANCE OF WEST AFRICAN DWARF (WAD) RAMS

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Thirty-two ram lambs of the West African Dwarf (WAD) sheep weighing between 14.2 and 19.9 kg and of between 10 and 12 months of age were randomly divided on a weight basis into four groups of eight animals each. The four groups were used to study the effect of feeding grass hay and concentrate in the ratios of 1:0 (A), 2:1 (B), 1:1 (C), and 1:2 (D). All animals were fed ad libitum in individual feeding pens throughout the 84 day experimental period. The performance parameters compared were : feed intake, rate of gain, feed conversion, carcass characteristics and economics of production.

The animals fed grass hay alone (A) made significantly ($P < 0.05$) smaller daily weight gains, required more feed per unit of gain, had lower dressing percentages and had less carcass fat. Increasing the level of concentrate in the rations resulted in significant increases in average daily gains ($P < 0.05$), a progressive decrease in the amount of feed required per unit of gain, higher dressing percentage and more carcass fat. While the feed cost (naira/kg feed) increased with increasing level of concentrate, the feed cost per unit of gain (naira/100 kg gain) decreased.

Key words: West African Dwarf Sheep, Hay:concentrate ratio, liveweight gain, carcass characteristics

Sheep are kept mainly for mutton in Nigeria, and they account for about 11% (48,000 metric tons; Adu and Ngere 1979) of the total meat supply. In addition, fattened rams are favourite slaughter animals during Muslim festivals at which time they command very high prices. This contribution is almost entirely from the Northern Nigerian breeds of sheep (Uda and Yankassa) which are kept and reared in commercial flocks by the Fulani herdsmen of Northern Nigeria. These Northern breeds of sheep are unsuited to the tsetse fly-infested southern areas where the West African Dwarf (WAD) breed of sheep thrives. The WAD sheep, unlike the Northern Nigerian breeds, act as scavengers, fending for themselves among the human settlements. They grow very slowly (Adeleye and Oguntona 1975) and reach slaughter weight at well over three years of age (Williamson and Payne 1959). Under the present feeding and management system (extensive system of husbandry), the WAD sheep carcass has little or no back fat, and minimal intramuscular fat (Dettmers and Loosli 1974). The extent to which good nutrition and management could improve the productivity of the WAD sheep is not known since they are not reared in large commercial flocks.

The present experiment was therefore conducted to obtain information on the ratio of hay to concentrate in feedlot fattening of WAD rams suitable for commercial production.

Materials and Methods

For this trial, 32 ram lambs of the West African Dwarf (WAD) breed of sheep were selected from the University of Ibadan flock. The experimental animals were between 10 and 12 months of age and weighed between 14.2 and 19.9 kg. Prior to their selection, the main flock was managed semi-intensively. The animals were grazed in the mornings from 0800 h to 1200 h on Giant Star Grass (*Cynodon nlemfuensis*) containing a few stands of *Centrosema pubescens*, and kept inside a concrete-floored barn during the hot hours of the day and at night.

Two weeks before the experimental feeding period, the animals were drenched for internal parasites with thiabenzadole. They were weighed and randomly divided on weight basis into 4 groups of 8 animals each. 4 experimental rations were formulated as follows:

(A) Control - Grass hay alone (1:0)

(B) - 2 parts grass to 1 part concentrate (2:1)

(C) - 1 part grass hay to 1 part concentrate (1:1)

(D) - 1 part grass hay to 2 parts concentrate (1:2)

The hay was a mixture of Giant Star grass and *Centrosema pubescens* and contained about 7.1 percent crude protein and 38% crude fibre. The hay was coarsely chopped and later hammer milled to pass a 12.5 mm sieve.The concentrate portion was composed of ground yellow maize, groundnut cake, palm kernel meal and rice bran. In addition, each experimental ration contained salt (with cobalt and iodine). Also, 1.5 kg feed-grade urea was mixed with each 100 kg of ration A in an attempt to make the rations isonitrogenous. Ingredient composition and chemical analysis of experimental rations are presented in Table 1.

Table 1:

Composition and chemical analysis of experimental diets fed to West African Dwarf (WAD) fattening rams

Ingredients (%)	Cost[1] (N/kg)	Grass hay : concentrate ratio 1:0 (A)	2:1 (B)	1:0 (C)	1:2 (D)
Grass hay	0.08	98.0	66.0	50.0	33.0
Yellow maize (ground)	0.25	-	16.0	32.0	49.0
Groundnut cake	0.35	-	7.5	7.5	7.5
Palm kernel meal	0.08	-	5.0	5.0	5.0
Rice bran	0.08	-	5.0	5.0	5.0
Salt (Iodine & Cobalt)	0.40	0.5	0.5	0.5	0.5
Urea (feed-grade)	0.01	1.5	-	-	-
		100.0	100.0	100.0	100.0
Chemical analysis:					
Dry matter (%)		85.36	83.91	82.33	81.18
Crude protein (% DM)		11.27	11.04	11.35	11.78
Ether extract (% DM)		2.41	4.63	4.89	4.92
Ash (% DM)		8.92	6.84	6.15	5.76
Crude fibre (% DM)		35.96	28.22	24.37	19.41
N.F.E (% DM)		41.44	49.27	53.24	58.13

[1] Naira/kg

The four rations were randomly assigned to the four groups of animals. The rams were fed ad libitum in individual feeding pens to allow voluntary feed intake to be determined. Seven days were used as adjustment period, at the end of which the animals were weighed to obtain their initial live weight and feed consumption measurements were commenced. Fresh feed was offered daily at 0900 h at which time refusals of previous day's feed were weighed and sampled. All animals had access to clean fresh water supplied daily in plastic buckets. They were weighed weekly in the mornings following overnight fast, during which the animals had no access to feed or water. At the end of the experimental period (12 weeks), the animals were weighed on two consecutive days; the first weighing was used to obtain the final liveweight. Thereafter , the animals had no access to either feed or water for a 24 hour period prior to the second weighing to obtain the shrunk body weight (slaughter weight). This was necessary in order to reduce the variation in liveweight usually associated with gut fill (Bass and Duganzich 1980). Immediately after the second weighing , the animals were slaughtered and dressed at the University abattior. Slaughtering was by severance of the jugular blood vessels and simultaneous dislocation of the neck. The blood from each animal was drained into a pre-weighed plastic bucket and weighed. The hot carcass and the non-carcass parts were separately weighed. The carcass was then chilled for 48 hours after which the left side of the carcass was separated into lean, bone and fat by mechanical separation.

The data for feed intake, rate of gain and carcass characteristics were analysed using the analysis of variance (Steel and Torrie 1960) and significance between treatments means determined by Duncan's(1955) multiple range test.

Results and Discussion

Data on the average daily gain, average daily dry matter intakes,feed conversion, and analysis of cost of production of WAD sheep as affected by the ratio of hay to concentrate in the ration are presented in Table 2. The rates of gain for all groups of animals were generally low, ranging between 50.8 and 149.5 g/d. This range of gain is normal with the West African Dwarf sheep owing to their small mature size (Williamson and Payne 1959; Adeleye 1980). The rams fed hay alone (ration A) had significantly ($P < 0.01$) lower daily gains and required more feed ($P < 0.01$) per unit gain than those fed a mixture of hay and concentrate. There were also

Table 2:
Feedlot performance of fattening WAD rams fed hay and concentrate at different ratios

Parameter	Ration Grass hay : concentrate ratio			
	1:0 (A)	2:1 (B)	1:1 (C)	1:2 (D)
Average initial weight (kg)	17.00	16.96	16.96	16.92
Average daily gain (g)	50.8^{a}	75.7^{b}	111.3^{c}	149.5^{d}
Feed conversion (kg feed/kg gain)	11.55^{a}	7.29^{b}	4.62^{c}	3.10^{d}
Feed cost (naira/100 kg feed)	8.00	13.00	16.00	19.00
Production costs (naira/100 kg LWG)	93.00	94.00	74.00	59.00

^{a,b,c,d}Means having different superscripts on the same line are significantly different: ($P < 0.01$)

highly significant differences ($P < 0.01$) in the daily weight gain and feed conversion values between the groups fed different ratios of hay to concentrate. Animals fed the ration containing the least proportion of hay (ration D) had the highest daily weight gains, followed by those fed ration C, containing equal amounts of hay and concentrate and then those fed ration B, containing two parts hay and one part concentrate. Similarly, there were highly significant differences ($P < 0.01$) in the feed conversion values between the groups fed hay and concentrate at different ratios. Animals fed ration D required less feed ($P < 0.01$)/unit of gain, than those fed with ration C, which in turn required less feed ($P < 0.01$) than those fed with ration B. It was clearly evident from the results of this trial that each level of concentrate addition resulted in significant increases in the daily liveweight gain and decreases in the amount of feed/unit of gain. These results are similar to those of Pahnish et al (1951), Keith et al (1952), and Whiting(1957) who fed diets varying in concentrate to hay ratios of between 2:1 and 1:2 to yearling steers. These workers reported increased average daily gains and decreased total feed consumption/unit of gain as the proportion of concentrate in the diets increased. Dowe et al (1955) also fed yearling steers diets with concentrate to hay ratios of between 1:1 and 5:1. They reported that the steers fed the diet containing concentrate and hay in the ratio 2:1 made the most rapid gains.

In the present study, average daily feed intake decreased significantly ($P < 0.01$) with increasing levels of concentrate. This observation is most likely due to increased digestible energy (DE) intake from rations containing higher levels of concentrate (McCullogh 1970a). It is also well known that animals on ad libitum feeding will attempt to equalize their DE consumption (Montgomery and Baumgardt 1965). The average intake of ration A (hay alone)which was significantly higher ($P<0.01$) than those of the other rations, but yet resulted in the least average daily weight gain, might indicate a possible restriction of rumen capacity on the animals' ability to maximize its DE intake.

From the observed data on feed intake and utilization, it appears as if the optimum hay to concentrate ratio for fattening WAD rams has not been reached in the present study. Under commercial conditions, the relative costs of concentrate and roughage would be the main factor to consider in determining the most economical proportion of concentrate and roughage to feed. In the present trial, however, the feed cost/unit of gain appears to be an important factor in deciding upon the most economical ration to feed rather than the cost of feed per se (Table 2).

An average local farmer with a large flock might not be able to afford the initial capital outlay in providing diets similar to the best ration in this study, nevertheless, the trial has clearly indicated a superior feedlot performance of WAD rams when fed rations containing 50% concentrate or more than when fed lower ratios of concentrate to hay or hay alone.

The carcass results are presented in Table 3. The percent shrinkage loss following food deprivation in order to obtain the slaughter weights of the animals, was significantly higher ($P < 0.05$) in animals fed rations containing 50% or more concentrate (rations C and D).

Table 3:

Carcass characteristics of fattened WAD rams fed hay and concentrate at different ratios

Parameter	Ration Grass hay: concentrate ratio			
	1:0 (A)	2:1 (B)	1:1 (C)	1:2 (D)
Average final weight (kg)	21.27	23.32	26.31	29.48
Average slaughter (shrunk) wt (kg)	20.87	22.85	25.57	28.62
Shrinkage loss (%)	1.88[a]	2.02[a]	2.81[b]	2.92[b]
Mean carcass weight (kg)[1]	11.56[a]	12.31[a]	14.50[b]	16.72[c]
Mean dressing percentage	55.39[ab]	53.87[a]	56.71[b]	58.42[c]
Carcass separation:				
Lean (kg)	7.81[a]	8.09[a]	9.77[b]	11.54[c]
as % of carcass	67.56	65.72	67.38	69.02
Bone (kg)	3.46	3.61	3.58	3.66
as % of carcass	29.93[a]	29.33[a]	24.69[b]	21.89[c]
Fat (%)	0.18[e]	0.56[f]	1.08[g]	1.42[h]
as % of carcass	1.56[e]	4.55[f]	7.45[g]	8.49[h]
Non-carcass parts (kg):				
Head (with horns)	1.68	1.74	1.71	1.75
Trotters	0.31	0.33	0.38	0.41
Skin (with hair)	1.09	1.56	1.76	2.20
Drainable blood	0.82	0.86	0.80	0.87
Digestive tract (full)	4.42	4.68	4.77	4.85
Digestive tract (empty)	1.20	1.51	1.63	1.94
Ingesta	3.22	3.17	3.14	2.91
Heart	0.06	0.06	0.07	0.08
Lungs	0.20	0.22	0.21	0.21
Liver	0.30	0.39	0.42	0.39
Kidney	0.04	0.04	0.05	0.05
Spleen	0.02	0.03	0.03	0.03
Testes	0.30	0.31	0.30	0.34

[1] Based upon slaughter weight and cold carcass weight.

Means having different superscripts on the same line are significantly different:
a, b, c $(P < 0.05)$
e, f, g, $(P < 0.01)$

There were significant $(P < 0.05)$ differences in the mean carcass weight of the experimental animals (Table 3). The difference between mean carcass weight of group A and B animals was not significant $(P > 0.05)$. The group D animals had the highest dressing percentage $(P < 0.05)$ while the values for the other groups overlapped.

There were significant differences ($P < 0.05$) between the groups in the amount of lean and fat in the carcass. A positive relationship was observed between the amount of lean meat and fat in the carcass and the proportion of concentrate in the experimental rations. The group A animals had no measurable back fat and the only separable fat in the carcass was around the kidneys. This observation agrees with the findings of Dettmers and Loosli (1974) that the WAD sheep on extensive system of husbandry is almost totally devoid of intramuscular fat and the amount of backfat is minimal. As the level of concentrate in the ration increased, the amount of lean meat and separable fat in the carcass also increased. The group D animals had the highest ($P < 0.05$) amount of lean and fat in the carcass. However, increasing the concentrate level of the ration had no significant effect on the lean muscle when expressed as a percentage of the carcass. Price et al (1978) obtained similar results when they noted that increasing the roughage level in the diet of steers and bulls reduced all measures of carcass fatness but had no significant effect on the muscle content. McCullough (1970b) also noted that the level of hay in the diet of Friesian steers tended to affect the amount of fat in the carcass, but the amount of lean muscle was similar at the different ratios of concentrate to hay. There were no significant differences ($P > 0.05$) in the amount of bone in the carcass between experimental groups. However, when the amount of bone in the carcass was expressed as a percentage of the carcass, group A animals had significantly higher proportion of the carcass as bone ($P < 0.05$) than those in groups C and D, while group B animals had about the same percentage bone in the carcass as group A animals.

There were no general relationship of all the non-carcass parts with the ratio of hay to concentrate in the ration. However, certain parts showed specific relationships with the level of concentrate in the rations. For example there was a general increase in the weight of the skin as the level of concentrate increased. Physical examination of the skin showed that the skin became thicker and the amount of subcutaneous fat became greater with increasing level of concentrate in the ration. The digestive tract (full) also increased in weight with increasing level of concentrate. However, the amount of ingesta in the digestive tract decreased with increasing level of concentrate.

From the above results, it is clearly evident that the WAD sheep do respond to feedlot feeding, and that their productivity in terms of mutton can be improved by including concentrate in their diet. The ratio of concentrate to hay in the fattening ration to be fed will, however, depend on the relative costs of roughage and concentrate and also on the financial capability of the local farmers.

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