BIOECONOMICS OF FEEDING RAW OR HEAT TREATED SOYABEANS TO BROILERS

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ABSTRACT

The bioeconomics of feeding full-fat raw (RSB), toasted (TSB), cooked (CSB) soyabeans or defatted soyabean meal (SMB) to broiler chicks at starter and finisher phases was investigated using 240 Anak strain broiler chicks. At starter phase RSB diet significantly ($P < 0.05$) depressed average daily intake (ADI) only when compared with SMB diet. It also significantly ($P < 0.01$) depressed daily weight gain (DWG): with values of RSB (20.1 gm), TSB (24.2 gm), CSB (24.0 gm) and SMB (25.3 gm) as well as feed conversion ratio of RSB (3.03) TSB (2.63), CSB (2.49) and SMB (2.58). At finisher phase, the effects were not significant ($P > 0.05$) suggesting adaptation of the chick to RSB with time. SMB diet was almost twice as costly to produce as the other three diets. Cost of feed per unit of weight gained was highest ($P < 0.05$) with SMB diet followed by RSB diet while CSB and TSB diets were similar at starter phase. At finisher phase SMB diet still had significantly ($P < 0.01$) higher cost per kg weight gain than the RSB, TSB and CSB diets whose values were statistically the same. On gross margin, the use of SMB diet significantly ($P < 0.01$) resulted in the lowest values, followed by the RSB diet while the values of CSB and TSB diets remained similar and the highest at both phases. This underlines the importance of using cost of food consumed to obtain a unit of product as a basis for recommending feeds to farmers (along side other nutritional factors).

Key words: Bioeconomics, Raw, Heat-treated, Soyabeans, Broilers

INTRODUCTION

A statement on food consumed and product obtained should provide basic data in

evaluating rations for farm animals (Maynard *et al.*, 1979). Feed conversion ratio (FCR) is an important performance index in animal production. FCR is the expression of the quantity of feed consumed to obtain a unit of the product. Changes in feed cost parallel the changes in feed conversion ration (Sonaiya *et al.*, 1986). Feeds and feeding constitute about 70 - 80% of production cost in poultry. The cost of food consumed to obtain a unit of product should therefore form a basis for recommending feeds to farmers.

In the present study, the economics of the biological effects of feeding rations containing full-fat raw, toasted, cooked or defatted soyabeans to broiler chicks at both starter and finisher phases was investigated.

MATERIALS AND METHODS

240 day-old Anak strain broiler chicks were randomly assigned to four isocaloric and isonitrogenous maize-soyabean diets containing either raw (RSB), toasted (TSB), cooked (CSB), full-fat soyabean or defatted soyabean meal (SMB) with soyabean supplying approximately 61% of the total protein in each diet (see Table 1). Each diet group (i.e treatment) was replicated three times with 20 chicks per replicate. From day-old to 10 days of age, all the chicks were feed a proprietary commercial broiler starter mash (Proximate composition in Table 1) *ad libitum* in order to stabilize them. Thereafter, they were fed the four treatment diets.

Toasting and cooking were done at 140°C and 100°C respectively for 30 minutes according to IFSP (1988) recommendation. The cooked beans were dried at 60°C for 10hr using a locally constructed forced draft oven. All beans - raw, toasted or cooked (and dried)

TABLE 1: COMPOSITION (%) OF SOYABEAN-BASED BROILER DIETS

Ingredients	Starter Diets				Finisher Diets			
	RSB	TSB	CSB	SMB	RSB	TSB	CSB	SMB
Maize	52.19	53.22	52.19	54.57	8.50	9.12	8.50	10.30
Maize grits	-	-	-	-	30.00	30.00	30.00	30.00
Maize offal	-	-	-	-	17.00	17.00	17.00	17.00
Soyabean	31.91	30.88	31.91	29.53	24.00	23.38	24.00	22.11
BDG	12.00	12.00	12.00	12.00	8.00	8.00	8.00	8.00
PKC	-	-	-	-	8.00	8.00	8.00	8.00
Bone meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Premix*	0.40	0.40	0.40	0.40	1.00	1.00	1.00	1.00
Salt	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Total	100	100	100	100	100	100	100	100
Proximate Composition (%) of DM)								
Commercial Feed +	RSB	TSB	CSB	SMB	RSB	TSB	CSB	SMB
CP	23.85	24.23	24.24	24.23	24.42	21.67	21.73	21.67
CF	5.95	5.65	5.74	5.63	5.75	6.50	6.60	6.30
Ash	6.00	5.50	5.55	5.52	5.62	5.80	5.73	5.60
EE	12.95	13.19	13.28	13.21	9.03	13.35	13.46	12.42
NFE	51.25	51.43	51.19	51.41	55.18	52.68	52.64	53.01

* Supplied per Kg of diet: Vit. A. 6412 IU; Vit. D3-3164 IU; Vit E - 731 IU; Vit K - 4.6 mg; Riboflavin - 7.4 mg; pyridoxine - 0.4mg; Nicotinic acid, 31mg; Ca pantothenate - 12.2mg; Folic acid - 0.98mg; Vit B12 - 16mcg; cholin chloride - 147.3mg; Fe - 19.64mg; Mn - 63mg; Cu - 9.98mg; Zn - 52.7mg; I 1.02mg; Co - 1.25mg; Se - 8mg; Methionine - 245mg.

were ground in a hammer mill to pass through a 1.5mm sieve. Soyabean meal was prepared by solvent extraction of previously cooked and ground beans. This was soaked in normal hexane for about 1h with stirring at intervals of 10 minutes. The solvent was drained out through a muslin cloth and the residue sun-dried for about 48hr.

Feeding of starter and finisher diets lasted for 35 days and 21 days, respectively. Feed and water were offered *ad libitum* on deep litter. Feed consumption was recorded daily and the chicks were weighed weekly.

Feed samples were assayed for proximate components by the method of A.O.A.C. (1980). Data obtained were subjected to analysis of variance (Snedecor and Cochran, 1980) and Duncan (1955) Multiple Range Test was applied to partition means, where necessary (Duncan, 1955). The cost per unit weight gained as a result of using any of the diets was obtained by using: $\text{Cost/Kg wt gain (N)} = \text{Unit (kg) cost of feed} \times \text{Wt of feed required for 1 kg body wt gain (i.e. FCR)}$. Since every factor or cost input involved in the management of the four treatment groups was constant except cost of feed, gross margin was determined based on cost of feed only.

RESULTS

Responses of the broiler chicks to the four dietary treatments at both phases are shown in Table 2. Chicks fed the SMB diet consumed larger ($P < 0.05$) quantity of feed than chicks fed the RSB and CSB diets but not those fed the TSB diet at starter phase. Also, relative to the other three diets, the RSB diet depressed ($P < 0.01$) both the DWG and FCR. At finisher phase, there were no significant differences ($P > 0.05$) among the dietary treatments in all three parameters studied. Mortality of chicks was also not significantly affected.

On economic consideration, the cost of producing a kilogramme of each of TSB and CSB diets was only marginally higher than that of RSB diet while that of SMB diet almost doubled the cost of each of the other three diets at both phases (Table 3). Cost of feed consumed to make a unit weight gain (Table 3) showed that SMB diet had the highest value at both starter ($P < 0.05$) and finisher ($P < 0.01$) phases and on the average ($P < 0.01$). TSB and CSB values were similar but higher than RSB values at starter phase and on the average, whereas at finisher phase values of the three were statistically the same.

TABLE 2: EFFECT OF DIETARY SOYABEANS ON PERFORMANCE

Parameters	Diets				SEM
	RSB	TSB	CSB	SMB	
(a) Starter Phase					
Av. daily Feed Intake (g)	60.8 ^b	63.6 ^{ab}	59.9 ^b	65.3 ^a	0.52*
Av. Daily wt. gain (g)	20.1 ^b	24.2 ^a	24.0 ^a	25.3 ^a	0.23**
Feed Conversion Ratio	3.03 ^a	2.63 ^b	2.49 ^b	2.58 ^b	0.02**
(b) Finisher Phase					
Av. Daily Feed Intake (g)	114.6	124.7	125.6	181.8	2.98
Av. Daily wt gain (g)	33.7	41.7	41.2	39.1	2.30
Feed Conversion ratio	3.42	3.00	3.05	3.12	0.12
(c) Mortality (%)	5.00	0.67	6.67	5.00	

TABLE 3: EFFECTS OF DIETARY SOYABEAN ON ECONOMICS OF PRODUCTION

Parameters	Diets				SEM
	RSB	TSB	CSB	SMB	
Actual cost (₦) /kg feed					
Starter mash	6.83	6.97	7.01	13.98	-
Finisher mash	7.56	7.67	7.70	12.66	-
Relative costs (%)					
Starter mash	48.89	49.88	50.12	100.00	-
Finisher mash	59.73	60.55	60.82	100.00	-
Cost (₦) of feed/kg weight gain					
Starter phase	20.69 ^b	18.33 ^c	17.45 ^c	36.07 ^a	0.57*
Finisher phase	25.86 ^b	23.01 ^b	23.49 ^b	39.50 ^a	0.86**
Average	22.28 ^b	20.67 ^c	20.47 ^c	37.79 ^a	0.17**
Gross margin (₦) from weight gain					
Starter phase	31.12 ^b	39.59 ^a	39.95 ^a	25.65 ^c	1.14**
Finisher phase	27.78 ^{ab}	36.90 ^a	35.91 ^a	20.91 ^b	2.74**
Total	58.90 ^b	76.49 ^a	75.86 ^a	46.55 ^c	2.69*

a,b,c: Means on the same row not followed by the same letter are significantly different at 5% (*) or 1% (**).

₦ = Naira (Nigeria's Official currency)

Also, results of gross margin (GM) analyses showed SMB treatment group to have the lowest values at both phases ($P < 0.01$) and on cumulative basis ($P < 0.05$), though at finisher phase SMB value was not statistically different from RSB value. TSB and CSB values were similar and highest at starter phase and on cumulative consideration but similar to RSB value at finisher phase.

DISCUSSION

The results of the starter phase showed that although the RSB diet was consumed as well as the CSB and TSB diets, chicks fed the RSB diet had highly significantly depressed DWG and FCR compared to chicks fed heat-treated

soyabeans. Thus there was no problem with the intake of the RSB diet but rather with its utilization. Chernick *et al.* (1948) had reported abnormally high quantities of trypsinogen and chymotrypsinogen in the pancreas of chicks fed raw soyabeans. The high levels of these inactive compounds in the pancreas have been interpreted to mean that the anti-trypsin in raw soyabeans inhibited the activation of trypsinogen to trypsin and thus subsequently inhibited intestinal proteolysis in the chicks fed the raw soyabean diets (Alumot and Nitsan, 1961).

At finisher phase, the similarity of the feed intake values further confirms the argument of no problem with intake of raw soyabean. But

non significant depression of DWG and FCR was also observed at this phase. This suggests some adaptation of broiler birds to raw soyabean diet with prolonged feeding.

The similarity in mortality percentages in all the treatment groups in this experiment indicates that the deaths in the RSB diet group were not due to toxicity of the raw soyabeans. The similarity in the efficiency of utilization of TSB, CSB and SMB diets as manifested in FCR was not reflected in the cost of feed per unit weight gained at the starter phase, rather it followed the same trend as the cost of producing the feed consumed. This shows that the high cost of a unit of body weight gained by broiler chicks that consumed the SMB diet is not due to low efficiency of utilization of the SMB diet but due to its high cost of production. On the other hand, the higher cost of feed per unit weight gained by chicks fed RSB diet was due to poor utilization of the RSB diet since the RSB diet had the least cost per unit of feed. The results of the finisher phase further confirm the above two points. Values for RSB, TSB and CSB diets were statistically the same just as were also the case with the DWG and FCR values for the three diets. The higher cost per unit weight gained by chicks fed SMB diets at the finisher phase was therefore due to the high cost of production of the SMB diet.

Gross Margin (GM) values (N) from weight gained at both phases followed almost the same trend as the cost of feed per unit weight gained at both phases. This shows that either of these factors can be an indicator of the profitability of using a feed. On cumulative basis, TSB and CSB diets produced the highest GM followed by RSB diet while SMB diet produced the lowest value. This shows that although a feed may be utilized with high efficiency, its high cost of production may eventually cancel out the effect of the high efficiency of utilization and result in low profitability on using the feed.

Farming is a business, and the goal of every business is to make profit. In poultry business, as in any other business, minimization of input or maximization of output results in higher

"profit". In the same vein, cost minimization or revenue maximization means higher profit. Hence it is necessary to consider cost effectiveness along with other nutritional factors in recommending method of preparing an ingredient for incorporation in feed. In the present experiment, toasting or cooking as methods of processing full-fat soyabean for incorporation in broiler diets proved to be more cost effective than using either full-fat raw or defatted soyabean meal.

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