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UTILIZATION OF *Leucaena* AND *Sesbania* LEAF MEALS AS PROTEIN SUPPLEMENTS IN BROILER RATION

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Abstract

One hundred twenty, two weeks old ISA Vedette broiler chicks were randomly allotted to four dietary treatments to investigate the effect of replacing fishmeal with two unconventional sources of leaf meals. The chicks were distributed into dietary treatments A (control-12% CP from fish meal), B (5% CP of fish meal replaced by *Leucaena*), C (5% CP of fish meal replaced by *Sesbania*) and D (2.5% CP of fish meal by *Leucaena* + 2.5% CP of fish meal by *Sesbania*) having three replications in each treatment group having 10 chicks in each replication. The results showed that *Leucaena* and *Sesbania* could be well utilized in broiler ration with no deleterious effects. Replacement of CP at 5% level by *Sesbania* leaf meal was slightly superior to that of *Leucaena* or a mixture of *Sesbania* and *Leucaena* in respect of broiler performance. Profit per kg live weight gain and per kg dressing yield at 5% level of CP replaced by *Sesbania* were only slightly superior over 12% CP from fish meal, 5% level of CP from *Leucaena* or a mixture of two leaf meals respectively. The findings also revealed that *Leucaena* and *Sesbania* leaf meals might replace individually or mixture of two leaf meals at 5% level of CP of fish meal for broiler production without affecting performance.

Key words: *Leucaena*, *Sesbania*, Protein supplement, Broiler ration

Introduction

Feed cost is approximately 65-70% of the total cost of broiler production. Scarcity and high price of good quality feed specially protein rich feed ingredients is one of the important constraints to improving the productivity of poultry in Bangladesh. Well balanced quality rations are essential for proper growth of broilers. There are certain energy or protein rich unconventional sources of feed ingredients that could be effectively used in the preparation of poultry feeds. Many of which have been proved to be successful (Lee and Yang, 1976; Singh and Sibudhi, 1978 and Rao *et al.*, 1982). However, there are some roughage sources of high nutritional grades particularly in protein and micronutrient (vitamins ad minerals) which could be tested as protein supplements for poultry. *Leucaena leucocephala*, a legume forage, has been the interest of many poultry scientists to utilize as feed for poultry. The results showed that

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Leucaena could be considered as good source of plant protein supplement which also contains vitamins and minerals (Meulen *et al.*, 1979). It was also reported that *Leucaena* leaf meal is an excellent source of beta-carotene which could be a valuable characteristics, particularly during dry season when *Leucaena* is able to retain as a green leaf better than any other pasture species (Jones, 1979).

Sesbania rostrata is another leguminous plant which is recently introduced in Bangladesh for green manuring of crop land and for feed of livestock. Its dry matter yield is higher than that of local variety and it can be propagated vegetatively. It fixes more nitrogen from the air than *azolla* and other legumes (Barroga, 1989). As a result, it is able to grow luxuriantly in water logged, saline, alkaline and highly cultivated soils. Its high herbage yield and protein content may make it a promising feed for poultry and livestock (Barroga, 1989). Studies have shown that *Sesbania rostrata* contains more dry matter and has a higher CP content than *Sesbania aculeate* (Akbar *et al.*, 1993).

Leucaena and *Sesbania* leaves can easily be grown abundantly in Bangladesh with little cost and agronomical care. The leaf, thus available, is much cheaper than other essential feed ingredients such as fish meal. Therefore, the present experiment was undertaken to assess the effect of using different levels of CP from *Leucaena* and/or *Sesbania* leaf meal replacing fish meal qualitatively on growth rate, feed consumption, feed efficiency, slaughter parameter and economic feasibility of broilers.

Materials and Methods

One hundred twenty, two weeks old ISA Vadette unsexed broiler chicks were used for randomly allocated 4 treatments. The treatment were A (control-12% fish meal), B (5% crude protein of fish meal (FM) replaced by *Leucaena*), C (5% crude protein of FM replaced by *Sesbania*) and D (2.5% CP of fish meal by *Leucaena* + 2.5% CP of fish meal by *Sesbania*). There were three replications in each treatment group having 10 chicks in each replication. Nutrient level in the diet was adjusted in accordance with NRC (1984) feeding standard. The composition (g/100 g) of the broiler starter and finisher diet is shown in Table 1 and Table 2 respectively. Feed samples were collected and analyzed according to the procedure of AOAC (1990).

The chicks were fed starter diet for during 2-4 weeks and finisher diet during 5-7 weeks of age. Before starting the experiment, the chicks were fed starter control diet for a week. Feeds were supplied *ad libitum* as dry mash throughout the experimental period. Strict hygienic measures and proper management procedures were followed. Initial and weekly weights of the broilers were recorded. Feed consumption of birds with was recorded replication wise weekly. At the end of the experiment one male and one female bird were selected from each group and they were weighed, slaughtered and allowed to bleed for two minutes. Giblet were retained to determine the dressing yield. Data were

for different variables and subjected to analysis of variance in accordance with the principle and procedures of completely randomized design (Steel & Torrie, 1980). Significance differences were identified by Duncan's New Multiple Range Test (DMRT).

Table 1. Ingredient and nutrient composition of starter ration

Parameters	Treatment[#]			
	A	B	C	D
Ingredient composition (g/100 g)				
Wheat	43.00	43.00	43.00	43.00
Wheat bran	5.00	5.44	5.53	4.43
Rice polish	14.00	14.00	14.00	15.00
Til oil cake	12.00	11.00	11.00	11.00
Fish meal	12.00	11.40	11.40	11.40
Leucaena leaf meal	-	1.16	-	0.58
Sesbania leaf meal	-	-	1.07	0.54
Soybean seeds	13.00	13.00	13.00	13.00
Oyster shell	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
Vitamin-mineral premix (kg)	0.25	0.25	0.25	0.25
Nutrient composition (g/100 g air dry sample)				
Dry matter	89.99	89.90	88.25	88.98
Crude protein	23.12	22.90	22.94	22.91
Crude fibre	5.47	5.73	5.73	4.46
Ether extract	4.98	4.19	4.97	5.81
Nitrogen free extract	48.64	49.23	49.26	45.72
Ash	5.45	5.66	4.48	4.39
Calcium	1.26	1.47	1.46	1.22
Total Phosphorus	0.88	0.82	0.82	0.72
Amino acids[a]				
Lysine	1.021	1.059	1.033	1.044
Methionine	0.443	0.442	0.428	0.438
Tryptophan	0.348	0.337	0.337	0.338
Metabolizable energy (kcal/kg)	2948	2944	2944	2964
Cost (Tk/kg)	12.23	12.07	12.07	12.10

[a] Calculated values, [#]A (control) -12% fish meal, B - 5% CP of fish meal replaced by *Leucaena*, C - 5% CP of fish meal replaced by *Sesbania* and D - 2.5% CP of fish meal by *Leucaena* + 2.5% CP of fish meal by *Sesbania*

Table 2. Ingredient and nutrient composition of finisher ration

Ingredients	Treatment[#]			
	A	B	C	D
Ingredient composition (g/100 g)				
Wheat	46.00	47.00	46.00	47.00
Wheat bran	3.00	3.44	2.53	2.40
Rice polish	20.00	19.00	20.00	20.00
Til oil cake	14.00	13.00	14.00	13.00
Fish meal	12.00	11.40	11.40	11.40
Leucaena leaf meal	-	1.16	-	0.58
Sesbania leaf meal	-	-	1.07	0.54
Soybean oil	3.00	3.00	3.00	3.00
Oyster shell	1.50	1.50	1.50	1.50
Salt	0.50	0.50	0.50	0.50
Vitamin-mineral premix (kg)	0.25	0.25	0.25	0.25
Nutrient composition (g/100 g air dry sample)				
Dry matter	87.45	87.45	87.42	87.22
Crude protein	20.20	19.94	20.10	19.91
Crude fibre	5.0	5.0	5.0	5.0
Ether extract	8.57	8.34	8.55	8.47
Nitrogen free extract	49.05	49.54	49.10	49.42
Ash	4.72	4.64	4.70	4.63
Calcium	1.86	1.82	1.84	1.82
Phosphorus	0.90	0.87	0.88	0.88
Amino acids[a]				
Lysine	0.758	0.796	0.776	0.73
Methionine	0.416	0.398	0.408	0.40
Tryptophan	0.317	0.306	0.311	0.306
Metabolizable energy (kcal/kg)	3109	3106	3113	3112
Cost (Tk/kg)	11.72	11.58	11.56	11.57

[a] Calculated values, [#]A (control) -12% fish meal, B - 5% CP of fish meal replaced by *Leucaena*, C - 5% CP of fish meal replaced by *Sesbania* and D - 2.5% CP of fish meal by *Leucaena* + 2.5% CP of fish meal by *Sesbania*

Results and Discussion

The performances of broilers fed on different levels of CP from *Leucaena* and/or *Sesbania* leaf meal and their effects are shown in Table 3. The daily average live weight gain was 42.34, 40.39, 40.88 and 39.95 (g/bird) in treatment groups A, B, C and D, respectively. The results showed similar trends, in respect of differences among the

values, as in the case of starter or finisher stages of growth of birds. The values for live weight gain of birds irrespective of groups did not differ significantly (P>0.01) although weight gain for control group (A) was slightly higher than those of the supplemented groups (B, C and D). Among the values for supplemented groups, the birds of group C showed slightly better weight gain than those of the other groups.

Table 3. Effects of partial replacement of fish meal by different levels of CP from *Leucaena* and/or *Sesbania* leaf meal on growth performance of broiler chicks (7-49 days)

Parameters	Treatments[#]				SEM	Level of sig.
	A	B	C	D		
Initial live weight (g/bird)	62.7	63.3	63.3	63.3	0.67	NS
Final live weight (g/bird)	1841	1760	1780	1741	45.21	NS
Total live weight gain (LWG) (kg/bird)	1.778	1.696	1.717	1.678	0.04	NS
Average LWG (g/bird/d)	42.34	40.39	40.88	39.95	1.07	NS
Average feed consumption (g/bird/d)	94.78^{a}	90.63^{b}	90.39^{b}	89.53^{b}	0.26	**
Feed conversion ratio (feed intake/LWG)	2.24	2.25	2.21	2.25	0.06	NS
Protein intake (g/bird/d)	19.95^{a}	18.85^{bc}	18.91^{b}	18.60^{c}	0.06	**
Energy intake (kcal ME/bird/d)	287	274^{b}	273^{b}	272^{b}	0.79	**
Protein conversion efficiency (g CPI/g LWG)	0.48	0.47	0.47	0.48	0.01	NS
Energy conversion efficiency (kcal MEI/g LWG)	6.78	6.80	6.70	6.83	0.18	NS

[#] A (control) -12% fish meal, B - 5% CP of fish meal replaced by *Leucaena*, C - 5% CP of fish meal replaced by *Sesbania* and D - 2.5% CP of fish meal by *Leucaena* + 2.5% CP of fish meal by *Sesbania*

NS = Non-significant

** P<0.01, Means bearing uncommon superscripts differ significantly

Birds of control group receiving fish meal ration gave significantly higher values than those of supplemented groups will respect to protein and energy take. However, the only difference was that the birds receiving *Sesbania* (Dhaincha) supplemented ration (group C) consumed more protein than those receiving *Leucaena* (B) or mixture of the legumes (D). The reason of higher protein and energy intake in control group could be due to higher palatability of the ration containing fish meal than those of the supplemented rations. Similar findings were reported by Hathcock *et al.* (1975) who included graded levels of *Leucaena* leaf meal at each of the three dietary protein levels, 150, 250 and 350g CP/kg ration. At each protein level, increasing dietary concentration of leaf meal (129, 214 and 300 g/kg) depressed growth, feed intake and efficiency of feed conversion. This assumption is also supported by the results of total feed intake of birds which was also significantly higher in control group (A) compared to those of the supplemented groups, during the whole experimental period. Daily average gain of chicks fed control ration were slightly superior to the supplemented groups fed *Leucaena* and/or *Sesbania*. However, the average daily gains were not significantly different between the treatments (P>0.05). It indicates that the groups of birds

supplemented with either *Leucaena* or *Sesbania* or a combination of both resulted in, although not significant, reduced growth rate. The reason could be the presence of toxic factors/anti-nutrients such as mimosine in *Leucaena* and canavanine in *Sesbania* having adverse effect on the productivity in poultry. This view is supported by the findings of Hussain *et al.* (1991). They reported reduced weight gains in boilers fed with 20% shade dried *Leucaena* leaf meal. Reduced weight gains in broilers fed *Sesbania* supplemented rations might be due to toxic inhibitor canavanine, an unusual amino acids, which acts as an antimetabolite to a nutritionally important amino acid called arginine as reported by Barroga (1989). The reason for slight increase in live weight gain in *Sesbania* supplemented groups over *Leucaena* supplemented groups could be due to adverse action of mimosine on live weight in *Leucaena* groups as more pronounced than that of canavanine in *Sesbania*.

The difference in feed conversion ratios (FCR) of different dietary groups of broilers were not significant although the birds receiving the ration C supplemented with *Sesbania* converted feed to meat slightly more efficiently than the remaining groups including the control. Similar findings were also reported by previous workers that there was no significant differences between the control and *Leucaena* supplemented groups (D'Mello *et al.,* 1978; De-*Leucaena*-Cruz, 1984; Hussain *et al.,* 1991). The reason for slightly improved FCR in the birds fed on *Sesbania* ration over the *Leucaena* supplemented ration was that the canavanine in *Sesbania* might have less adverse action on growth of birds than that of mimosine in *Leucaena*. In addition, the presence of tannin in *Leucaena* might have adverse effect on the digestibility feed consumed by the birds of those groups. There are reports that tannins exerts adverse effects, specially in poultry, by reducing protein digestibility through the formulation of complexes with dietary protein and the inhibition of the activities of the proteolytic enzymes in digestive secretions (D'Mello, 1982). The presence of tannin in *Leucaena* has also been reported by D'Mello and Fraser (1981). However, the difference of FCR in dietary treatments was not significant. All the birds were healthy throughout the experimental period which indicates that *Leucaena* and *Sesbania* leaf meal in the ration showed no significantly detrimental effect on the health of the broiler.

The effect of feeding *Leucaena* and *Sesbania* leaf meal on slaughter weight, carcass yield, dressing percentage and weight of different body parts and organs of the experimental birds are shown in Table 4. Significantly ($P<0.01$) better carcass yield was obtained in birds given rations A and C than those of the birds fed on rations B and D. However, the differences were not significant in birds fed on rations A and C or B and D. The significant ($P<0.01$) higher weight of thigh meat and drumstick meat of the birds of control and *Sesbania* (C) supplemented groups compared to those of *Leucaena* (B) and mixture (D) supplemented groups might be due to less deposition of protein in the latter groups in the presence of mimosine from *Leucaena*.

The production cost (Tk.) of each kilogram of broiler fed on different rations is shown in Table 5. Feed cost per kg live weight gain was Tk. 26.88, 26.62, 26.14 and 26.54 for rations A, B, C and D respectively, but the differences were not significant. The lowest feed cost (Tk.) per kg live weight gain was 26.14 for ration C and the highest was 26.88 for ration A (control group-A). The feed costs per kg live weight gain were almost similar for rations B and D.

Table 4. Effect of crude protein replacement of fish meal by different combination of *Leucaena* and *Sesbania* leaf meal on carcass and non-carcass characteristics of broiler chicks

Parameters	Treatment[#]				SEM	Level of sig.
	A	B	C	D		
Slaughter weight kg/bird)	1.82^{a}	1.62^{b}	1.81^{a}	1.63^{b}	0.05	*
Carcass weight (kg/bird)	1.21^{a}	1.06^{b}	1.21^{a}	1.05^{b}	0.02	**
Dressing percentage	65.33	64.10	65.31	63.30	0.95	NS
Weight of different body parts and organs (g/bird)						
Liver	39.13	33.3	37.23	33.10	2.29	NS
Heart	10.6^{a}	7.5^{b}	9.07^{ab}	9.07^{ab}	0.62	*
Head	53.27	47.00	46.67	47.97	1.76	NS
Empty gizzard	30.33	26.97	30.93	27.97	2.61	NS
Shank	85.60	76.53	74.20	71.73	3.11	NS
Feather	177.33	167.33	178.00	169.33	7.42	NS
Ingesta of gizzard	9.07	10.47	6.93	9.57	1.38	NS
Thigh meat	193.93^{a}	154.40^{c}	186.07^{ab}	161.20^{bc}	6.36	**
Drumstick meat	171.73^{a}	138.90^{b}	164.04^{a}	139.57^{b}	5.21	**
Breast meat	232.07	216.8	257.87	218.13	10.08	NS
Wing meat	104.07	108.53	109.57	102.07	7.85	NS
Neck meat	55.33	50.17	53.83	56.50	3.34	NS

[#] A (control) -12% fish meal, B - 5% CP of fish meal replaced by *Leucaena*, C - 5% CP of fish meal replaced by *Sesbania* and D - 2.5% CP of fish meal by *Leucaena* + 2.5% CP of fish meal by *Sesbania*

NS = Non-significant, *P<0.05, **P<0.01

[abc] Means bearing dissimilar superscripts differ significantly

Feed cost per kg live weight gain and per kg dressing yield of birds of different groups throughout the experimental period were not significant. However, the highest cost of feed in the group A, receiving fish meal ration was due to the high price of fish meal. The feed cost in group C, receiving *Sesbania* supplemented ration was the lowest compared particularly to those of the group B and D (*Leucaena* and *Leucaena* + *Sesbania* supplemented) were presumably, due to higher protein and energy contents of *Sesbania* than in *Leucaena* and consequently reducing the amount of other protein and energy sources. This has led to the reduction in cost of feed in *Sesbania* supplemented ration. The higher profit per kg live weight gain and per kg dressing yield

in birds of group C receiving *Sesbania* ration might be due to lower cost of feed in this ration compared to others. However, the difference in profit per kg live weight gain and per kg dressing yield between treatments was not statistically significant.

Table 5. Effect of crude protein replacement of fish meal by different combination of *Leucaena* and *Sesbania* leaf meal on carcass and no-carcass characteristics of broiler chicks

Parameters	Treatment[#]				SEM	Level of sig.
	A	B	C	D		
Feed cost (Tk/kg LWG)	26.88	26.62	26.14	26.54	0.70	NS
Feed cost (Tk/kg dressing yield)	41.22	41.51	40.43	41.93	1.18	NS
[1]Cost of production (feed+chicks) (Tk/LWG)	36.45	36.67	36.04	36.69	0.96	NS
[2]Cost of production (feed+chicks) (Tk/kg dressing yield)	55.88	57.19	55.19	57.97	1.62	NS
[3]Profit (Tk/kg LWG)	23.55	23.33	23.96	23.31	0.96	NS
[4]Profit (Tk/kg dressing yield)	29.12	27.81	29.81	27.03	1.62	NS

[#] A (control) -12% fish meal, B - 5% CP of fish meal replaced by *Leucaena*, C - 5% CP of fish meal replaced by *Sesbania* and D - 2.5% CP of fish meal by *Leucaena* + 2.5% CP of fish meal by *Sesbania*
NS = Non-significant
[1, 2] Calculating chick cost (Tk. 17/bird), [3, 4]Assuming sale revenue (Tk. 60/kg live weight and Tk. 85/kg dressing yield)

Conclusion

Based on the findings stated above, it may be concluded that 5% level CP from fish meal would be replaced by *Leucaena* and *Sesbania* leaf meal in broiler ration without any noticeable adverse effects on the overall performances of the birds. Replacement of CP at 5% level by *Sesbania* leaf meal was slightly superior to that by *Leucaena* or mixture of *Sesbania* and *Leucaena* in respect of broiler performance. However, further study with similar objectives with higher level of replacement is needed for a firm conclusion.

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