Effect of the Replacement of Soybean Meal by Rubber Seed Meal on Growth, Economics and Carcass Characteristics of Broiler

INTRODUCTION

Soybean meal is using in the broiler ration up to 30% as a protein source ingredients. Soybean meal contains 38-40% protein and 18-20% fat and it is the excellent source of lysine, tryptophan and threonine (Banaszkiewicz, 2011; Reddy and Bhosale, 2001). However, the cost of soybean meal is increasing day by day and it increases the total feeding cost of broiler. In addition persistent shortages of the conventional feedstuffs for livestock feeding in the developing countries are caused largely by inadequate production of farm crops to meet the needs both of humans and of their domestic animals. Therefore, it is a challenged to prepare a good ration by inoculation of non-conventional feed ingredient for minimizing the feed costs. The non-conventional feed resources refer to all those feeds that have not been traditionally used in animal feeding and or / are not normally used in commercially produced rations. One of the non-conventional feed resources is rubber seed meal, which are obtained from rubber tree seed (Hevea brasiliensis). The average nutrient composition of rubber seed meal was ash 3.10%, neutral detergent fiber (NDF) 53.8%, crude fat 28.4% and nitrogen 2.39% in dry basis (Chhay Ty and Phiny, 2001). In addition these seeds are very rich in oil and...
Replacement of Soybean Meal by Rubber Seed Meal in Broiler Ration

MATERIALS AND METHODS

The experiment was conducted in the Animal Nutrition Laboratory at Chittagong Veterinary and Animal Science University, Bangladesh from October to December, 2012 on Cobb 500 broilers.

Collection and preparation of rubber seed and broiler chick

Rubber seed was collected from a privet rubber garden of Balakata, Banderban, Chittagong, Bangladesh. The seeds were sun dried for 8 to 10 days. Then the seeds were crushed in blender machine to produce the rubber seed meal (RSM). A total of 150 day-old commercial broiler chicks (Cobb 500 strain) were purchased from an agent of Kazi Hatchery, Chittagong, Bangladesh.

Layout of the experiment

Chicks were equally and randomly divided and distributed in to five dietary treatment groups (T0 (without RSM), T1 (10% RSM), T2 (20% RSM), T3 (30% RSM) and T4 (40% RSM)) having two replication in each. Each dietary treatment group consists of 30 chicks, distributed in two replicated pens.

Brooding of baby chicks

The experiment was conducted in winter season. The ambient temperature was very low during this period. The chicks will be brooded in respective pens at a temperature of 90-95 °F during 1st week, 90-85 °F during 2nd week, and 85-80 °F during 3rd week with the help of electric light for maintaining proper temperature.

Medication and vaccination

At first week Gluco-C® was used @ 50 gm/L water. From 1st day megavit® WS was used @ 1 gm/5 L water. The birds were vaccinated against Newcastle and Gumboro diseases on the 5th and 10th day followed by a booster dose on 18th and 26th day.

Chemical analysis

The feed ingredients and the broiler meats were analyzed to determine their proximate components as AOAC (1980) method in the Animal Nutrition Laboratory, Department of Animal Science and Nutrition and Poultry Research and Training Centre (PRTC) of Chittagong Veterinary and Animal Science University, Chittagong.

Effects of feeding rubber seed meal on body weight gain and feed intake and costs benefits

The chicks hatched out weight was taken and recorded. Two types of ration (broiler starter and broiler finisher) was formulated and prepared (Table 1 and 2). Starter ration was given from 1 to 21 days where rubber seed meal (RSM) were supplied half proportion of finisher ration and the finisher ration was given from 22 to 35 days. Feed was supplied ad libitum along with fresh and clean drinking water. Weekly body weight was taken using top loading balance and recorded and final body weight and weight gain of broiler was calculated from this recorded information. The average feed intake of the broilers was calculated from the differences between the supplied and leftover. The feed costs per treatment and per broiler were calculated from the available market price and finally costs benefit was calculated.

Evaluation of carcass characteristics

Experimental birds were slaughtered after 35 days of feeding trial to assess the carcass quality. Four birds were taken from each treatment group to measure the selected quality. Before slaughtering the birds were kept in fasting condition for 24 hours. Just before slaughtering the birds were weighed and slaughtered according to Halal method. Data were recorded in terms of live weight, breast meat weight, thigh bone weight, thigh meat weight, drumstick meat weight, drumstick bone weight, skin weight, abdominal fat weight, digestive tract weight, liver weight, gizzard weight, shank weight, heart weight, head weight, neck weight, spleen weight and wing weight. The dressing percentage was calculated as:

\[ \text{Dressing percentage} = \frac{\text{weight of the carcass}}{\text{weight of live animal}} \]
Statistical analysis
All recorded data were statistically analyzed using completely randomized design (CRD). The analyses were performed by SPSS statistical software (SPSS, 2011). The meat was converted to percentage of live weights prior to statistical analysis. Significant differences between means were identified by least significant differences (LSD) at 5% level of significance (Steel et al. 1997).

RESULTS AND DISCUSSION

Chemical composition of rubber seed meal
Dry matter (DM) percentage of rubber seed meal was 95.7. It contains 26.07% crude protein, 1.8% ash, 4.7% crude fiber and 10.8% ether extract. On the other hand soybean meal contains higher crude protein (45%) and lower ether extracts (2.9%) than rubber seed meal.
Mmereole (2008) analyzed rubber seed meal and found higher crude protein (34.10%) and ash (3.10%) than the current study and similar percentage of crude fiber and fat.

Effects of rubber seed meal on the production performance and carcass quality of broiler

Effect of rubber seed meal on live weight gain of broilers

The body weight gain of broiler containing different level of rubber seed meal shown in Table 3. There was no significant differences in initial body weight and body weight gain among the different treatment (P>0.05). The body weight was highest in broiler diet T2 containing 20% RSM which was 1395.25 g and the lowest (1268.78 g) in dietary treatment T4 containing 40% RSM. Nouke and Endeley (1989) used 300 Jupiter chickens to observe the effects of incorporating rubber seed meal supplemented with blood meal in broiler rations under traditional conditions. They observed average weekly body weight gain was 103.71 g within 1st to 6th week using 0% RSM. But in the current experiment the average weekly body weight gain was 261.84 g within 1st to 5th week using 0% RSM (Table 3). This difference might be due to the differences of broiler strain. Although the final body weight of broilers under different treatment groups was similar but the body weight gain was significantly higher in 10% and 20% RSM groups than control and these values was higher than Duong (2003), who found average daily body weight gain 6.08 g in 10% and 20% RSM treatment groups.

Effect of rubber seed meal on feed intake feed conversion ratio (FCR) of broiler

Total feed intake per bird of different dietary treatment is shown in Table 4. Birds of T1 consumed more feed than others where T0 intakes lowest amount of feed. There were no significant differences (P>0.05) found among the treatments. The average weekly feed intake was 457.264, 461.091, 461.718, 466.759 and 464.324g for T0, T1, T2, T3 and T4, respectively which was higher than Nouke and Endeley (1989). They observed 289.94, 130.70, 189.00, 209.98 g feed intake for the 0, 10, 20 and 30% RSM, respectively as supplemented with blood meal. Hutagalung (1981) observed that the optimum level of rubber seed meal in the ration was 10-30%. However in this experiment, rubber seed meal was used up to 40% of soybean meal and better result was found using rubber seed meal up to 20% of soybean meal. The feed conversion ratio (FCR) of birds (value±standard error) is presented in Table 3. The best FCR value (1.65±0.055) was found in T2 where we used 20% of rubber seed meal (RSM) and T4 (40% RSM) gave the worst FCR value (1.83±0.014). The FCR of T2 and T1 was similar.

Duong (2003) found FCR was 2.91 in control group (0% RSM) and 3.00 in T1 (10% RSM) by rearing native Tam Hoang chickens of vietnam. The growth rate and feed conversion ratio (FCR) are always good in broiler strain Cobb 500 due to their genetics. There it can be seen that 20% rubber seed meal (RSM) had best FCR in broiler.

Effect of rubber seed meal on feed cost and profit

Total feed cost per treatment and total feed cost per bird are shown in Table 1. During the experimental period the price of rubber seed was 25 Bangladeshi Taka (BDT)/kg (including processing cost). According to Table 6, T4 diet required the lower feed cost BDT 86.67 ± 0.409 / kg, where T0 comprises of higher feed cost BDT 89.83 ± 0.432 / kg and sale price of per kg bird was BDT 135. Net profit per bird was higher in T3 45.04 ± 3.19 BDT and lower in T4 (37.28±0.92 BDT). The ration containing soybean meal (T0) and the net profit was 37.72 ± 1.26 BDT / bird.

Effect of rubber seed meal on carcass quality and dressing percentage of broiler

Effects of rubber seed meal on the carcass characteristics and dressing percentage of broilers are given in Table 3. The slaughter data of broiler chicks RSM fed experiment was represented in g/100 g (%) of live weight. No significant (P>0.05) effect was observed for carcass weight and weights of internal organs of broilers fed experimental rations except the digestive tract weight and head weight. Rubber seed meal has an effect on digestive tract weight; birds of higher body weight gain have the smaller digestive tract. The breast meat weight was higher in T1 (16.96±0.839 g) and lower in T4 (13.19±0.971 g). However, higher weight of head weight, neck weight and spleen weight were found in control group when compared with broilers in groups fed different level of RSM. Thigh bone weight and gizzard weight are almost same in T0 and T4. Highest gizzard weight found in both T0 and T4 was 2.95 g/100 g live weight. Ekenyem and Madubuike (2006) used Ipomoea asarifolia leaf meal and found liver weight ranges from 1.435 to 2.125 and gizzard weight 1.475 to 2.85 gm for 0, 5, 10 and 15% IALM.

The highest dressing percentage (60.51±0.097) was found in T1 and the lower (54.40±1.166) T4 (Table 4). Ekenyem and Madubuike (2006) used Ipomoea asarifolia leaf meal (IALM) and found dressing percentage 63.63, 63.41, 63.38 and 62.30 using 0, 5, 10 and 15% IALM, respectively.

Effect of rubber seed meal on chemical composition of broiler meat

Results obtained from proximate analysis of meat from five treatment groups shown in Table 5.
with 30% rubber seed meal and T4: indicates broiler fed with 40% rubber seed meal.

T0: indicates broiler without rubber seed meal; T1: indicates broiler fed with 10% rubber seed meal; T2: indicates broiler fed with 20% rubber seed meal; T3: indicates broiler fed with 30% rubber seed meal and T4: indicates broiler fed with 40% rubber seed meal.

* (P<0.05).

NS: non significant.

The means within the same row with at least one common letter, do not have significant difference (P>0.05).

SE: standard error.

### Table 4: Weekly average daily feed intakes of broilers feed containing rubber seed meal

<table>
<thead>
<tr>
<th>Age</th>
<th>T0 (Mean±SE)</th>
<th>T1 (Mean±SE)</th>
<th>T2 (Mean±SE)</th>
<th>T3 (Mean±SE)</th>
<th>T4 (Mean±SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st week</td>
<td>17.49±0.047</td>
<td>17.35±0.136</td>
<td>17.3±0.316</td>
<td>18.14±0.088</td>
<td>17.07±0.044</td>
</tr>
<tr>
<td>2nd week</td>
<td>51.89±0.015</td>
<td>51.27±0.610</td>
<td>51.47±0.101</td>
<td>52.1±0.337</td>
<td>51.66±0.800</td>
</tr>
<tr>
<td>3rd week</td>
<td>65.8±0.113</td>
<td>66.00±0.357</td>
<td>65.99±0.385</td>
<td>66.57±0.009</td>
<td>66.60±0.003</td>
</tr>
<tr>
<td>4th week</td>
<td>83.7±0.196</td>
<td>84.48±0.494</td>
<td>84.40±0.812</td>
<td>85.52±0.101</td>
<td>85.67±0.009</td>
</tr>
<tr>
<td>5th week</td>
<td>117.7±1.720</td>
<td>120.22±0.616</td>
<td>120.42±0.104</td>
<td>121.05±0.534</td>
<td>120.62±0.806</td>
</tr>
</tbody>
</table>

Tc: indicates broiler without rubber seed meal, T1: indicates broiler fed with 10% rubber seed meal, T2: indicates broiler fed with 20% rubber seed meal, T3: indicates broiler fed with 30% rubber seed meal and T4: indicates broiler fed with 40% rubber seed meal.

SE: standard error.

### Table 5: Effect of rubber seed meal on carcass quality and dressing percentage of broiler

<table>
<thead>
<tr>
<th>Slaughter data (%)</th>
<th>T0 (Mean±SE)</th>
<th>T1 (Mean±SE)</th>
<th>T2 (Mean±SE)</th>
<th>T3 (Mean±SE)</th>
<th>T4 (Mean±SE)</th>
<th>P-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breast meat weight</td>
<td>16.22±1.740</td>
<td>16.96±0.839</td>
<td>15.52±1.339</td>
<td>14.51±0.573</td>
<td>13.19±0.971</td>
<td>0.306</td>
<td>NS</td>
</tr>
<tr>
<td>Thigh bone weight</td>
<td>1.80±0.270</td>
<td>1.56±0.026</td>
<td>1.49±0.226</td>
<td>1.50±0.103</td>
<td>1.80±0.137</td>
<td>0.578</td>
<td>NS</td>
</tr>
<tr>
<td>Thigh meat weight</td>
<td>8.64±0.016</td>
<td>8.22±0.241</td>
<td>8.46±0.766</td>
<td>8.17±0.073</td>
<td>7.44±0.322</td>
<td>0.358</td>
<td>NS</td>
</tr>
<tr>
<td>Drumstick meat weight</td>
<td>2.80±0.577</td>
<td>3.34±1.062</td>
<td>2.16±0.045</td>
<td>2.67±0.033</td>
<td>3.35±0.959</td>
<td>0.723</td>
<td>NS</td>
</tr>
<tr>
<td>Drumstick bone weight</td>
<td>2.80±0.577</td>
<td>3.34±1.062</td>
<td>2.16±0.045</td>
<td>2.67±0.033</td>
<td>3.35±0.959</td>
<td>0.723</td>
<td>NS</td>
</tr>
<tr>
<td>Skin weight</td>
<td>7.05±0.521</td>
<td>7.18±0.455</td>
<td>7.41±1.145</td>
<td>6.88±0.289</td>
<td>7.51±0.044</td>
<td>0.942</td>
<td>NS</td>
</tr>
<tr>
<td>Abdominal fat weight</td>
<td>1.56±0.477</td>
<td>1.35±0.003</td>
<td>2.18±0.593</td>
<td>2.08±0.084</td>
<td>2.70±0.680</td>
<td>0.361</td>
<td>NS</td>
</tr>
<tr>
<td>Digestive tract weight</td>
<td>8.35±0.124</td>
<td>7.56±0.018</td>
<td>7.61±0.051</td>
<td>9.54±0.049</td>
<td>10.50±0.914</td>
<td>0.015</td>
<td>NS</td>
</tr>
<tr>
<td>Liver weight</td>
<td>2.30±0.041</td>
<td>2.22±0.011</td>
<td>2.50±0.140</td>
<td>2.41±0.052</td>
<td>2.53±0.227</td>
<td>0.452</td>
<td>NS</td>
</tr>
<tr>
<td>Gizzard weight</td>
<td>2.95±0.046</td>
<td>2.81±0.000</td>
<td>2.55±0.151</td>
<td>2.64±0.284</td>
<td>2.95±0.009</td>
<td>0.310</td>
<td>NS</td>
</tr>
<tr>
<td>Shank weight</td>
<td>4.92±0.140</td>
<td>4.62±0.340</td>
<td>4.96±1.012</td>
<td>5.03±0.032</td>
<td>5.01±0.130</td>
<td>0.548</td>
<td>NS</td>
</tr>
<tr>
<td>Heart weight</td>
<td>0.64±0.125</td>
<td>0.56±0.037</td>
<td>0.62±0.005</td>
<td>0.49±0.044</td>
<td>0.52±0.026</td>
<td>0.451</td>
<td>NS</td>
</tr>
<tr>
<td>Head weight</td>
<td>0.64±0.057</td>
<td>0.56±0.058</td>
<td>0.62±0.049</td>
<td>0.49±0.014</td>
<td>0.52±0.026</td>
<td>0.007</td>
<td>*</td>
</tr>
<tr>
<td>Neck weight</td>
<td>3.09±0.055</td>
<td>2.55±0.130</td>
<td>2.93±1.800</td>
<td>3.03±0.048</td>
<td>3.00±0.262</td>
<td>0.249</td>
<td>NS</td>
</tr>
<tr>
<td>Spleen weight</td>
<td>0.21±0.006</td>
<td>0.14±0.005</td>
<td>0.19±0.019</td>
<td>0.12±0.000</td>
<td>0.10±0.000</td>
<td>0.157</td>
<td>NS</td>
</tr>
<tr>
<td>Wing weight</td>
<td>6.94±0.080</td>
<td>6.69±0.075</td>
<td>6.82±0.429</td>
<td>6.97±1.141</td>
<td>6.44±0.395</td>
<td>0.668</td>
<td>NS</td>
</tr>
<tr>
<td>Dressing %</td>
<td>58.42±1.151</td>
<td>60.51±0.097</td>
<td>59.00±1.395</td>
<td>57.00±0.736</td>
<td>54.40±1.166</td>
<td>0.024</td>
<td>*</td>
</tr>
</tbody>
</table>

Tc: indicates broiler without rubber seed meal, T1: indicates broiler fed with 10% rubber seed meal, T2: indicates broiler fed with 20% rubber seed meal, T3: indicates broiler fed with 30% rubber seed meal and T4: indicates broiler fed with 40% rubber seed meal.

* (P<0.05) and ** (P<0.01).

NS: non significant.

The means within the same row with at least one common letter, do not have significant difference (P>0.05).

SE: standard error.
The result of chemical analysis of meat showing the similar dry matter in all dietary treatment and there was no significant difference (P>0.05) among the dietary groups. Maximum dry matter was found in group T₀ (26.21±0.325) and T₃ (24.92±0.091) was minimum. In case of CP% T₀ represents higher value (89.16±5.148) and T₄ represents lower value (81.63±4.717). But in case of EE %, T₀ represents lower value (7.2±0.411) and T₄ represents the higher value (9.88±0.018) and there was no significant difference (P>0.05) among the treatment groups. It may be due to the protein percentage and quality of rubber seed meal (26.07%) is lower than soybean meal (45%) whereas the value (9.88 protein percentage and quality of rubber seed meal (P>0.05) among the treatment groups. It may be due to the meat contains 0% fiber. Adeniyi 0.860  NS Ash % 5.23±0.066  5.12±0.015  5.20±0.022  4.96±0.009  5.10±0.092  NS CP % 89.16±5.148  82.51±0.385  82.07±2.988  77.52±1.438  81.63±1.717  NS EE % 7.2±0.411  8.1±0.755  9.47±0.265  9.63±0.107  9.88±0.018  NS CF % 0  0  0  0  0 -

*Only DM estimated in fresh basis, other components are estimated in DM basis.

DM: dry matter; CP: crude protein; EE: ether extracts and CF: crude fibre.
T₀: indicates broiler without rubber seed meal; T₁: indicates broiler fed with 10% rubber seed meal; T₂: indicates broiler fed with 20% Rubber seed meal; T₃: indicates broiler fed with 30% rubber seed meal and T₄: indicates broiler fed with 40% rubber seed meal.
NS: non significant.
SE: standard error.

**CONCLUSION**

This study reveals that at the age of 5th week the average body weights, feed conversion efficiency, dressing percentage and cost benefit ratios of broiler under 10% and 20% rubber seed meal treated groups were better than other treated groups. Among the 150 experimental broilers only one death occurred and no toxic or detrimental effect of rubber seed meal was found. Therefore it can be suggested that, soybean meal might be replaced by the rubber seed meal at 10-20% in the ration without any bad effect. However, further investigation and experiment will be required with large number of broiler to make a final recommendation.

**ACKNOWLEDGEMENT**

The authors are pleased to acknowledge the authority of ASPS II Adaptive Research programme by the Regional Fisheries and Livestock Development Component Government of Bangladesh (DLS and DoF)-DANIDA providing funds and support to complete the research. They are grate ful to the authority and staffs of Chittagong Veterinary and Animal Science University (CVASU) for the providing a good academic environment at CVASU. They also grateful to everybody, who help them directly or indirectly for conducting this research.

**REFERENCES**


**Table 6 Chemical composition of broiler meat (g per 100 g DM)**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>T₀ (Mean±SE)</th>
<th>T₁ (Mean±SE)</th>
<th>T₂ (Mean±SE)</th>
<th>T₃ (Mean±SE)</th>
<th>T₄ (Mean±SE)</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>DM %</td>
<td>26.21±0.325</td>
<td>25.62±0.079</td>
<td>26.19±0.505</td>
<td>24.92±0.091</td>
<td>26.16±0.860</td>
<td>NS</td>
</tr>
<tr>
<td>Ash %</td>
<td>5.23±0.066</td>
<td>5.12±0.015</td>
<td>5.20±0.022</td>
<td>4.96±0.009</td>
<td>5.10±0.092</td>
<td>NS</td>
</tr>
<tr>
<td>CP %</td>
<td>89.16±5.148</td>
<td>82.51±0.385</td>
<td>82.07±2.988</td>
<td>77.52±1.438</td>
<td>81.63±1.717</td>
<td>NS</td>
</tr>
<tr>
<td>EE %</td>
<td>7.2±0.411</td>
<td>8.1±0.755</td>
<td>9.47±0.265</td>
<td>9.63±0.107</td>
<td>9.88±0.018</td>
<td>NS</td>
</tr>
<tr>
<td>CF %</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

* Only DM estimated in fresh basis, other components are estimated in DM basis.

DM: dry matter; CP: crude protein; EE: ether extracts and CF: crude fibre.
T₀: indicates broiler without rubber seed meal; T₁: indicates broiler fed with 10% rubber seed meal; T₂: indicates broiler fed with 20% Rubber seed meal; T₃: indicates broiler fed with 30% rubber seed meal and T₄: indicates broiler fed with 40% rubber seed meal.
NS: non significant.
SE: standard error.


