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Effect of Napier Grass on Economic Turkey Production in Bangladesh

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Abstract

Objective: To test the hypothesis that a certain percent of Napier grass could be used as a replacement of concentrate for economic production of turkey. **Method/Analysis:** The feeding trial was a Completely Randomized Design (CRD) consisting of one control and two concentrate feed replacement treatments. Three treatments were: T_1 = 100% concentrate (control), T_2 = 75% concentrate + 25% grass and T_3 = 50% concentrate + 50% grass. Requirement of concentrate and Napier grass were determined and supplied on the basis of Dry Matter (DM). Turkeys of all treatments were fed with the feed of same composition. **Findings:** Significant (P<0.05) difference was observed in daily and weekly concentrate intake among the treatment groups. Napier grass intake also differed significantly (P<0.05). Similar final body weight was found in T_1 (2006 ± 102.5 g) and T_2 (2008 ± 77.5 g). Feed conversion efficiency was better (P<0.05) for T_2 (2.54 ± .01) and T_3 (2.63 ± 0.05) than T_1 (3.50 ± 0.05). Survivability rate was higher (P<0.05) in T_2 (100%) and T_3 (100%) than T_1 (93%). Production cost and profitability per turkey differed significantly (P<0.05). Although total revenue was similar in T_1 and T_2; net farm income, production index, rate of return on investment and capital turnover were significantly (P<0.05) higher in T_2. **Novelty:** Finally, it was concluded that on the basis of DM, replacement of 25% concentrate by Napier grass resulted in not only equal weight gain as like 100% concentrate but also reduced cost of production without causing any detrimental effects on turkey aged between 5 to 14 weeks. Therefore, farmers of Bangladesh could use this feeding system for economic turkey production.

Keywords: Concentrate, Feed Efficiency, Growth, Napier Grass, Turkey+

1. Introduction

Farmers of developed countries of Europe and America have been rearing turkey (Meleagris gallopavo) for meat since many years but it is gradually becoming popular in Bangladesh recently.

It has habit of eating grass in pasture. Its meat is an excellent source of protein and has a good price-quality ratio[1]. Hence, it is very important to know the factors influence the productive performance and yield of turkey[2]. Napier grass (Pennisetum purpureum*)* is a popular grass, cultivated particularly by farmers of Bangladesh for dairy cattle feeding. It contains comparatively higher crude protein than other forage but as it becomes mature Dry Matter (DM) increases and Crude Protein (CP) decreases[3]. So young stage of Napier grass could be an alternative for concentrate replacement for turkey.

Pressure is increasing on limited cultivable land of Bangladesh to produce rice for human consumption in the one hand and feeds in terms of concentrate and fodder production for feeding livestock, on the other hand. Because of increasing price of poultry feeds poultry industry of Bangladesh is searching alternatives without decreasing production performance of birds. Reducing the amount of concentrate by supplementing or replacing grass could be an effective alternative. In fact, farmers put most importance to feed efficiency because feed represents two-thirds of the total costs in poultry production.

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Importance of feed efficiency is high due to high cost of feed, which represents about 70% of the total cost of a turkey production system[4]. It is estimated that production and consumption of poultry meat in developing countries will increase by 3.6 percent per annum from 2005 to 2030 because of rising incomes, diversification of diets and expanding markets[5]. So it is important to the researchers of Bangladesh along with other developing countries to identify such a feeding system combining concentrate and fodder which could convert these feed components into meat more efficiently without compromising growth and profit.

Turkey is a good forager and according to the farmers of the Philippines feeding cost of turkey could be reduced almost 50% if green vegetables and grasses are used as supplement to commercial feeds[6]. By nature, poultry are omnivores and for this reason either supplying of quality grass or providing foraging opportunity could reduce the cost of production. It[7] was reported that poultry could eat 5-20% of their diet from pasture and alfalfa which is essential to supply unidentified nutrients[8].

Fiber has been regarded as nutrient diluents in poultry[9] and a certain amount of dietary fiber is necessary for proper development and physiological function of gastrointestinal tract. Several researchers found positive influence on growth performance of geese by feeding bulky feeds[10]. Diet substitution is a commonly accepted principle of poultry nutrition to meet protein and energy requirements in relation to different growth period[11]. Studies showed that inclusion of moderate amount of different fiber in diet improved organ development as the gizzard[12–14], increased HCL, bile acids and enzyme secretions[15,16]. Digestible fiber after broken down by the bacteria in the digestive tract of bird becomes an excellent food source for beneficial bacteria like Lactobacillus sp. and Bifidobacteria[17]. Feeding of fiber produce lactic acid and lower pH due to fermentation of fiber creates a difficult environment for Salmonella and other pathogenic populations[18]. On the contrary, there is controversy about the efficiency with poultry regarding use of feed rich in fiber[19].

Considering the above facts, it is necessary to find out a practical feeding system for economic turkey production. But there is little data available regarding use of Napier grass as a replacement of concentrate for turkey production in Bangladesh. Therefore, this study was carried out to test the hypothesis that a certain percent of Napier grass could be used as a replacement of concentrate for economic production of turkey.

2. Materials and Methods

2.1 Study Site and Duration of Experiment

The study was conducted at the Advanced Animal Research Farm of Faculty of Veterinary and Animal Science, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, Bangladesh. All experimental conditions and animal procedures were approved by the Animal Care and Ethics Committee of HSTU. The experiment lasted for 12 weeks (5 to 14 weeks age of turkey) during the months May to July 2016.

2.2 Experimental Design

The feeding trial was a Completely Randomized Design (CRD) consisting of one control and two concentrate replacement treatments. A total of 90, 4-week old poults were procured from a local turkey breeding farm. Poults were randomly allocated to three dietary treatment groups. Each group was made up of 3 replicates. The turkeys were reared in deep litter pens which were demarcated according to the diet groups. Both concentrate and fresh Napier grass were supplied to the treatment groups on the basis of Dry Matter (DM) and consumption pattern of turkeys. The amount of fresh grass for concentrate replacement was determined on the basis of DM intake of control group. DM content was kept equal for all groups. The feeding system of the three treatments was: Treatment 1(T_1) = 100% concentrate (control), Treatment 2(T_2) = 75% concentrate + 25% grass (on DM basis) and Treatment 3 (T_3) = 50% concentrate + 50% grass (on DM basis).

2.3 Turkey Management

Before arrival of poults the house was cleaned thoroughly with water and disinfectant. A foot bath was made in front of door of the house and it was dipped with potassium permanganate to maintain bio-security. All the turkeys involved in the experiment were treated equally in all respects, except supplying amount of concentrate and Napier grass. Turkeys of all treatments were fed with same diet. Commercial broiler grower concentrate feed

manufactured by Farms Limited, Bangladesh, was fed to the turkeys of all treatments.

The experimental concentrate feed was prepared by using maize, rice polish, soybean meal, full fat soybean, animal protein, vitamin-mineral premix, amino acid, salt, toxin binder and antioxidant. The composition of the concentrate feed is presented in Table 1.

Napier grass was cultivated at the fodder field nearby to the turkey shed. It is also known as "Elephant grass", "Sudan grass" or "King grass". It was supplied to the turkeys by hanging procedure. This grass was harvested at the early stages of growth (5-7 weeks) when the nutrients such as carbohydrate, crude protein etc. were at higher level. Composition of Napier grass as analyzed by[20] is given in Table 2 and it was also reported that young and immature Napier grass cut at 50 cm height were highly digestible.

Concentrate and water were supplied in plastic feeders and drinkers. Ad libitum water was made available all day long throughout the experimental period by using hanging drinkers. Before starting the experiment, a week was provided to the experimental turkeys as an adjustment period to be comfortable with their respective experimental diet. To avoid wastage and reduce the quantities of leftovers, supply of concentrate and grass was adjusted every week on the basis of consumption pattern. Concentrate and grass were supplied two times in a day: in the morning between at 8 : 30 to 9 : 00 a.m. and in the afternoon between at 3 : 30 to 4 : 00 p.m. To ensure freshness, grass was supplied directly from the field. Rice husk and wood shavings were used as litter. Each turkey was marked with colored plastic beads for proper identification. The environmental conditions of the experimental unit such as ventilation and illumination were supplied both naturally and mechanically. The environmental temperature was between 28-35°C and lighting schedule was 13 h light and 11 h dark in the experimental unit.

Table 1. Nutrient composition of the experimental concentrate for feeding turkey

Nutrient	Values
Metabolizable Energy (Kcal/kg)	3000
Crude protein (%)	19.3
Crude Fat (%)	5.0
Calcium (%)	0.90
Available Phosphorus (%)	0.42

Source: Aftab Bahumukhi Farms Limited, Bangladesh.

Table 2. Chemical composition of Napier grass (Pennisetum purpureum) at 50 cm height

Nutrient	**%**
Dry Matter (DM)	37
Ash	6
Crude Protein (CP)	13.29
Dry Matter Digestibility (DMD)	64
Neutral Detergent Fiber (NDF)	51.37
Acid Detergent Lignin (ADL)	3.5
Acid Detergent Fiber (ADF)	37
Macro element	
P	0.07
Ca	0.11
Mg	0.05
Na	0.17
Minor elements (ppm)	
Fe	193.6
Mn	39
Zn	50
Cu	6.6

Source: In[20].

2.4 Data Collection

2.4.1 Calculation of Productive Performance

Concentrate and Napier grass were supplied after weighing by using a digital balance daily. Left over concentrate and grass were also weighed daily. The litter was sieved to determine the concentrate in wastage. All turkeys were weighed to obtain the initial weight and subsequently weighed weekly to obtain the weekly body weight and body weight gain. Other parameters measured during this period include concentrate intake, Feed Conversion Efficiency (FCE) and survivability rate. Growth and feed efficiency were measured using fo.llowing equations:

$$Growth\,rate = \frac{Total\ weight\ gain\ in\ certain\ time}{Total\ days\ of\ the\ experiment}$$

$$Feed\ coversion\ efficiency\left(FCE\right) = \frac{Concentrate\ feed\ intake}{Body\ weight\ gain}$$

2.4.2 Calculation of Economic Performance

Economic performance calculation was done using market prices of feed ingredients and other necessary items to compare the costs of different treatments. Price of turkey, feed, grass, electricity, labor, medication etc. were taken into account on the basis of market price during the experimental period in Bangladesh. The financial values of the study were calculated on the basis of the national money unit of Bangladesh. Average exchange rate of Bangladesh Bank over the research period was 1 USD = 80 BDT.

2.4.2.1 Total Variable Cost (TVC)

TVC is the cost of variable inputs such as feeds, labor and drugs used for production and it changes directly with the level of production.

2.4.2.2 Total Fixed Cost (TFC)

TFC is the cost of permanent items that does not vary when output changes and therefore has no influence on production decisions in short run.

2.4.2.3 Total Revenue (TR)

TR is the total money value of all output produced whether sold, consumed or in stock.

2.4.2.4 Net Farm Income (NFI)

NFI means difference between total returns and total expenses for production. It was calculated using the following equation:

NFI = TR – (TVC + TFC).

Where; NFI = Net Farm Income (NFI), TR = Total Revenue, TVC = Total Variable Cost and TFC = Total Fixed Cost.

2.4.2.5 Profitability Index (PI)

Profitability Index (PI) means the Net Farm Income (NFI) per unit of Total Revenue (TR) and it was calculated using following equation:

$$PI = \frac{NFI}{TR}$$

Where; PI = Profitability Index, NFI = Net Farm Income and TR = Total Revenue

2.4.2.6 Rate of Return on Investment (RRI)

RRI is the performance measure used to evaluate the efficiency of an investment or to compare the efficiency of different investments. It is calculated dividing the net farm income divided by total cost of investment and usually expressed as a percentage or ratio. RRI was calculated using following equation:

$$RRI = \frac{NFI}{TC}$$

Where; RRI = Rate of return on investment, NFI = Net farm income and TC = Total cost.

2.4.2.7 Capital Turnover (CTO)

It is the ratio of total revenue to total cost. It measures the efficiency of a business and provides information on the capability of business to deliver return per unit of money invested. It tells the farmers whether the business is viable and capable of offsetting its own cost. CTO was measured using following equation:

$$CTO = \frac{TR}{TC}$$

Where, CTO = Capital turnover, TR = Total revenue and TC = Total cost

2.4.2.8 Depreciation

To calculate the worth of each fixed cost items, the straight line method of depreciation was used. It was measured using equation mentioned below:

$$Depreciation\,cost = \frac{Purchase\ price}{Number\ of\ useful\ years\ of\ the\ asset}$$

2.5 Statistical Analysis

Effect of treatment on body weight, feed intake, feed efficiency, survivability and profitability were analyzed using the One-way ANOVA procedure in accordance with a Completely Randomized Design (CRD) following the GLM procedure of SPSS computer software 22.00[21]. Significance of differences among the means of treatments was compared by using Duncan's Multiple Range Test of the same package. All data were expressed as Mean ± Standard Error of Mean (SEM). Differences were

considered significant at the level of P<0.05. The following linear model summarizes the statistics employed to analyze the data:

$Y_i = \mu + TR_i + E_i$,

Where; Y_i is the dependent variable, μ is the overall mean, TR_i is the treatment effect and E_i is the error.

3. Results and Discussion

3.1 Feed Intake and Growth

Results on concentrate and Napier grass intake, feed conversion efficiency, growth and survivability are presented in Table 3.

Both daily and weekly average concentrate intake differed significantly (P<0.05) among the treatment groups and highest concentrate intake occurred in T_1. Concentrate intake in different weeks showed steady upward trend for all treatment groups except for T_1 at 11th and 12th weeks when intake was lower (Figure 1). Average daily and weekly grass intake differed significantly (P<0.05) between T_2 and T_3 groups (Figure 2). Although initial body weight was similar for all treatment groups, final body weight differed significantly (P<0.05). Statistically similar final body weight was found for T_1 and T_2. Both daily and weekly body weight gain of T_3 were significantly (P<0.05) lower from T_1 and T_2. Body weight at different weeks was similar for T_1 and T_2 all along the experimental period except for the week 11th and 12th (Figure 3). Body weight of T_1 showed declined pattern for these two weeks. Concentrate intake was lower from 11 to 12th week in T_1 might be because of high environmental temperature (average 38°C) occurred during this period. But concentrate in take, for the same period was higher in T_2 and T_3 might be due to supply of fresh grass which minimized the problem of high temperature. After 12th week of age weight gain of T_3 group showed decline trend might be due to lower consumption of concentrate and higher supply of grass; which resulted in lower nutrient intake for the growing turkey.

Daily concentrate intake was significantly lower in T_2 than T_1 but daily body weight gain was statistically similar between T_1 and T_2. Equivalent final body weight in T_1 and T_2 indicates that replacement of 25% concentrate by Napier grass had no detrimental effects on body weight gain. Rather there was a positive correlation between concentrate and grass intake. This result could be supported by who reported that turkey can obtain nutrients from forage because this poultry species is better able to digest fiber due to larger microbial population in their digestive tracts. Because of inclusion of forage, 'grass factor' worked for growth[22]. Similarly, highly significant differences in weight gain adding different types of fodder to poultry diets were found[23]. A laying hen could consume up to 120 g forage in a day and intake of forage decreased concentrate consumption without altering

Table 3. Feed intake and growth performance of turkey fed on different level of Napier grass replacing concentrate

Variables	Dietary Treatment Groups			Level of significance
	T_1	T_2	T_3	
Initial body weight (g)	406.22 ± 40.57	407.00 ± 30.05	406.14 ± 20.57	NS
Av. weekly body weight gain (g)	151.10 ± 16.01[a]	157.05 ± 7.63[a]	101.00 ± 9.87[b]	*
Av. daily body weight gain (g)	21.31 ± 2.33[a]	22.33 ± 1.20[a]	14.33 ± 1.45[b]	*
Final body weight (g)	2006 ± 102.5[a]	2008 ± 77.5[a]	1190 ± 113.4[c]	*
Av. weekly concentrate intake (g)	585.33 ± 14.84[a]	399.00 ± 11.15[b]	265.00 ± 11.15[c]	*
Av. daily concentrate intake(g)	83.66 ± 4.67[a]	57.00 ± 4.01[b]	38.00 ± 6.05[c]	*
Feed conversion efficiency (FCE)	3.50 ± 0.05[a]	2.54 ± 0.01[b]	2.63 ± 0.05[b]	*
Av. daily Napier grass intake (g)	-	19.12 ± 2.03	35.67 ± .2.33	*
Survivability (%)	93.43 ± 7.49 [a]	100 ± 5.54 [b]	100 ± 4.41 [b]	*

Values are expressed as Mean ± SEM; [a,b,c]Means within a row without common superscripts differ significantly; NS-non significant; statistically significant difference is expressed as *(P<0.05). Here, T_1 = 100% con., T_2 = 75% con. + 25% grass (DM basis) and T_3 = 50%con.+ 50% grass (DM basis).

egg production[24]. Reducing of 15% concentrate had no detrimental effect on productivity of layers[25]. However, intake of forage materials depends on the type of forage materials. Poultry on pasture can consume 5 to 20% forage, depending on the age and quality of forage. However, although turkey can digest large quantity of fiber due to larger microbial population in their digestive tracts, this study showed that 50% concentrate replacement by grass was not suitable for the growing turkeys.

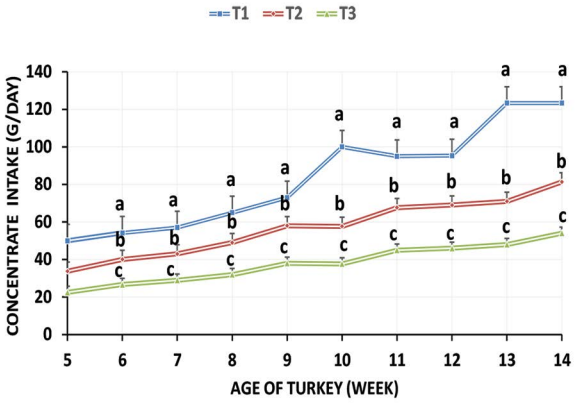

Figure 1. Weekly concentrate intake pattern of turkey. Each line with error bar represents the Mean ± SEM values; different letters above the error bars of the same feeding period indicate statistically significant differences (P<0.05). Here, T1 = 100% con., T2 = 75% con. + 25% grass (DM basis) and T3 = 50% con. + 50% grass (DM).

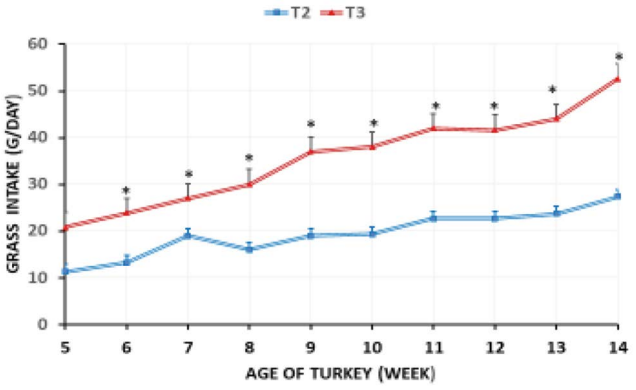

Figure 2. Weekly Napier grass intake pattern of turkey. Each line with error bar represents the Mean±SEM values; statistically significant difference is expressed as * (P < 0.05) between the groups.Here, T2= 75% con. +25% grass (DM basis) and T3=50% con. + 50% grass (DM basis)

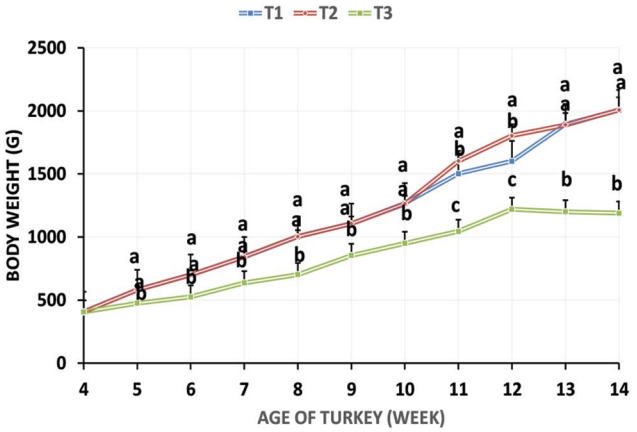

Figure 3. Average body weight of turkey in different weeks. Each line with error bar represents the Mean±SEM values; different letters above the error bars of the same feeding period indicate statistically significant difference (P < 0.05). Here, T1 = 100% con., T2 = 75% con. +25% grass (DM basis) and T3 = 50%con. + 50% grass (DM basis)

3.2 Feed Conversion Efficiency

FCE was similar for T_2 and T_3, but these were significantly (P<0.05) lower than T_1. Significantly higher FCE value for T_1 indicated poorer feed efficiency than T_2 and T_3. Statistically similar but lower FCE value for T_2 and T_3 indicated comparatively better feed efficiency. As the T_1 group consumed only concentrate, so FCE value was higher. This result reflects that replacement of certain amount of concentrate by palatable grass give better feed efficiency with higher body weight, which happened in T_2. This might be occurred because moderate levels of fiber acted as nutrient diluents and had not affect digestion and absorption of nutrients[26]. In fact, moderate amount of fiber increased space in gizzard which facilitated the function of HCL, bile acids and enzyme secretions. Feed efficiency of T_3 was better because of lower amount of supplied concentrate intake as per treatment, but final body weight was the lowest. This might have happened due to higher intake of grass which contained fiber and thereby decreased weight gain. This result was consistent with the findings of who reported that higher fiber concentration in diet can cause negative effects on nutrient digestion and absorption.

3.3 Survivability

Survivability rate differed significantly (P<0.05) among the experimental turkeys. Leg lameness and lesion on mouth was observed in turkeys of T_1 group at the age of 9th week and mortality occurred at 10th week due to severe weakness. On the other hand no mortality occurred in T_2 and T_3 groups during the experimental period. There might be several positive reasons for 100% survivability in addition to proper intensive management. Fresh grass could supply vitamin-mineral and might be a source of unidentified factors which gave good vigor and livability to the turkey. This result could be supported by the findings of[24] who observed in an indoor experiment 1.5 and 0.5% mortality in hens supplemented with maize silage and carrot, respectively, while15% mortality was occurred in non-supplemented hens. Besides, an improved immune response in laying hens with access to forage materials has been reported by[27], which might be one of the reasons for no mortality in the Napier grass supplied groups of the present study. In addition, forage materials have welfare benefits in terms of reduced feather pecking and other undesirable behavior[28].

3.4 Profitability

The cost and return items associated with turkey production in the study are presented in Table 4. Variable costs for labor, medication, water, electricity, litter and transportation were non-significant. But variable costs for concentrate and Napier grass differed significantly ($P < 0.05$). Though TFC did not differ significantly, TVC and TC differed significantly ($P < 0.05$). On the basis of market price total revenue was similar for T_1 and T_2 but it differed significantly ($P < 0.05$) from T_3. Profitability variables NFI, PI, RRI and CTO also differed significantly ($P < 0.05$) among the groups and these variables were highest for T_2.

In case of profitability analysis it was observed that concentrate cost was significantly (P<0.05) lower for T_2 and T_3 compared to T_1 because of using Napier grass. This result was in line with the findings of[29] who reported that Napier grass contain comparatively higher crude protein which served as a means of reducing feed cost. Intake of forage materials could reduce the concentrate consumption up to 20%[8]. Reduction of 12% concentrate intake was possible without altering egg production when birds were fed 108 g carrot per bird/day[24]. Inclusion of fresh forage to replace commercial concentrate for turkeys, help save money and could reduce production costs[30].

TVC varied significantly because of variable amount of concentrate and grass intake. Concentrate feed cost was lowest and grass cost was highest in T_3 group because this group consumed the lowest and highest amount of concentrate and grass, respectively. Similarly, TC differed significantly because of amount of concentrate and grass intake. But TFC remained same for all groups due to providing same facilities to all groups. Production cost per turkey was significantly lower in T_2 and T_3 due to replacement of concentrate by grass. But revenue per turkey was significantly lowest in T_3 group due to lowest weight gain. On the other hand significantly higher total revenue was generated from both T_1 and T_2 group due to higher body weight gain. NFI was highest for T_2 due to low feeding cost because of replacing concentrate by grass and gaining of higher body weight. Profitability parameters PI, RRI and CTO were significantly higher for T_2 because this group incurred low cost but gained body weight equal to T_1. From business point of view PI, RRI and CTO indicated that turkey farming following T_2 model of feeding system i.e. replacing concentrate by 25% Napier grass; gave best results. PI 0.43 for T_2 indicated that each BDT earned as revenue BDT 0.43, which returned to producer as net farm income. RRI 76.80% indicated each taka invested in turkey business generated 76.80% net farm income. CTO 1.77 implied that for each BDT invested in the turkey business returned to turkey producers as revenue BDT 1.77.On the other hand replacement of 50% concentrate by grass resulted in the lowest RRI, PI and CTO; which indicated no loss-no profit situation in this study. But following this feeding system in the long run would cause loss for the farming enterprise. This result was consistent with the findings of[31] who reported capital turnover of 1.54 by turkey producers in Zaria, Nigeria. Moreover, it was reported that higher RRI means better success of farm business and a capital turnover ratio greater than 1 is acceptable for a farm business. It implies that to maximize profit from turkey farming, there should to be a well-planned effort towards increasing the scale of production and efficient use of the inputs. This study showed that efficient use of expensive concentrate through proper rationing with Napier grass can result in lowering feeding cost, increasing income and profit from turkey farming. This result is in agreement with the findings of who reported that feeding cost of turkeys was reduced by using fresh forage in Oaxaca of Mexico.

Table 4. Cost and returns for per turkey production (calculation was made in BDT and on the basis of market price during the experimental period, in FY 2016-17)

Parameter	Dietary Treatment Groups			Level of significance
	T_1	T_2	T_3	
A. Variable cost				
Labor	95.5	95.5	95.5	NS
Concentrate	246 ± 13.55[a]	168 ± 12.67[b]	111 ± 12.57[c]	*
Napier grass	-	4.20 ± 0.05[a]	7.50 ± 0.05[b]	*
Medication	12.67	12.67	12.67	NS
Water	20.23	20.23	20.23	NS
Electricity	33.33	33.33	33.33	NS
Transportation	80	80	80	NS
Total Variable Cost (TVC)	487 ± 15.57[a]	414 ± 15.55[b]	361 ± 14.67[c]	*
B. Fixed costs				
Cost of poult	700	700	700	NS
Depreciation on housing @5%	24.33	24.33	24.33	NS
Depreciation on equipment@10%	1.67	1.67	1.67	NS
Total Fixed Cost (TFC)	726	726	726	NS
Total cost	1213 ± 109.4[a]	1140 ± 106.8[b]	1087 ± 107.7[c]	*
C. Revenue				
Sales of Turkeys	2006 ± 109.7[a]	2008 ± 108.7[a]	1190 ± 107.6[c]	*
Sales of litter	6.67 ± 0.33	6.67 ± 0.54	6.67 ± 0.57	NS
Total Revenue (TR)	2013 ± 107.7[a]	2015 ± 108.8[a]	1197 ± 107.5[b]	*
Net farm income (NFI)	799 ± 12.35[a]	875 ± 13.24[b]	110 ± 12.37[c]	*
Profitability index (PI)	0.40 ± 0.01[b]	0.43 ± 0.01[a]	0.09 ± 0.00[c]	*
Rate of return on investment (RRI)	65.87 ± 2.22[b]	76.80 ± 2.55[a]	10.14 ± 0.57[c]	*
Capital turnover(CTO)	1.66 ± 0.01[b]	1.77 ± 0.02[a]	1.10 ± 0.01[c]	*

Values are expressed as Mean ± SEM; [a,b,c] Means within a row without common superscripts differ significantly; NS-non significant; statistically significant difference is expressed as * ($P<0.05$). Here, T_1 = 100% con., T_2 = 75% con. +25% grass (DM basis) and T_3 = 50% con. + 50% grass (DM basis).

4. Conclusion

Finally, it was concluded that on the basis of DM, replacement of 25% concentrate by Napier grass resulted in not only equal weight gain as like 100% concentrate but also reduced cost of production without causing any detrimental effects on turkey aged between 5 to 14 weeks. Therefore, replacement of 25% concentrate by Napier grass could be recommended for the turkey farmers of Bangladesh. But further study is needed to reinforce the findings.

5. Acknowledgements

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