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Research Article

Nutrient Concentrations of Gizzard Contents of Scavenging Ducks in Haor Areas of Sylhet

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Abstract

An investigation was carried out with 16 ducks belonging to two age groups (14 weeks and 1.5 years) taking from haor areas of Sylhet regions reared under three feeding regimes. Ten layers were collected from Sunamganj on December and six growers were collected from Jaintiapur, Sylhet on July. The birds were divided into three dietary treatments. Diets for comparison were: T_1 (no feed supplement), T_2 (25g feed supplement per day and scavenging), T_3 (50g feed supplement per day and scavenging). The birds were sacrificed from farmer's house between 4.0 and 5.0 P.M. They were dissected to assess chemical composition of gizzard contents. Gizzard contents were collected and processed for proximate components. The average fresh weight of gizzard contents were 14.33 ± 3.68g, 21.83 ± 7.79g, 23 ± 0.82g for ducks receiving scavenging, 25g feed supplement and 50g feed supplement respectively. Gizzard contents contained 54.84 ± 6.37% DM, 53.245 ± 4.92% Ash, 1.39 ± 0.35% EE and 2.39 ± 0.41% CP for scavenging, 57.59 ± 6.29% DM, 47.71 ± 6.04% Ash, 2.45 ± 0.42% EE and 4.34 ± 1.05% CP for 25g supplementary feed with scavenging and 54.52 ± 2.53% DM, 46.76 ± 3.92% Ash, 3.93 ± 0.49% EE and 6.42 ± 1.09% CP for 50g supplementary feed with scavenging. CP and Ash contents were varied significantly ($P < 0.01$) with season, but contents of EE, DM were not influenced by season. During rainy season the crude protein and ash contents were higher than winter season. Crude protein was 5.55 ± 2.24% during rainy season and 3.87 ± 1.43% in winter season. Ash contents were 50.37 ± 3.09% and 47.33 ± 3.39% during rainy and winter season respectively. The number of bacteria of the gizzard content was around 10^3 - 10^6/ml. The bacterial population was 1.2×10^4/ml - 1.28×10^6/ml when ducks were scavenging, 1.1×10^4/ml - 1.8×10^4/ml and 7.2×10^3/ml - 1.8×10^4/ml when ducks receiving 25g and 50g supplementary diet respectively. It can be concluded that only scavenging is not enough for ducks and should be supplied at least 50g of supplemented feed. In future cost benefit analysis should be carried out.

Keywords: *Ether Extract; Dry Matter; Crude Protein; Ash Content; Gizzard; Feed Supplement*

Abbreviations

CFU: Colony Forming Unit; CGC: Crop and Gizzard Content; CP: Crude Protein; DM: Dry Matter; EE: Ether Extract; SAU: Sylhet Agricultural University; g: Gram; GC: Gizzard Content; SFRB: Scavenging Feed Resource Base; T: Treatment

Introduction

Poultry is playing an important role for human nutrition, national income, employment and income generation in developing countries. The importance of poultry as a source of income for landless and marginal farmers, especially women. In many developing countries, particularly Bangladesh poultry production in rural and peri-urban areas is based on traditional scavenging systems. It is estimated that about 80% of the poultry population, is found in traditional production systems. These husbandry systems are characterized by a low input/low output production system and contribute significantly to household food security in developing countries [2]. In traditional poultry production systems, different poultry species are kept and the most important being chickens, guinea fowls, ducks, pigeons, geese and turkeys. Productivity of these poultry species depends on the management systems adopted [5] and increases with the level of improved feeding and management.

Duck contributes major source of animal protein in Bangladesh and it is an important component of farming system and plays a significant role to rural economy [4]. Duck comprises of about 17% (57.75 million) of the total poultry population (347.03 million) and occupying second place next to chicken in the production of table eggs in the country [3]. Geographical advantages like natural feed resources, abundant water for swimming, tolerable temperatures etc. have made especially the North-Eastern part of Bangladesh suitable for duck farming.

Sunamgonj, Sylhet and Moulvibazar are water based area consists lots of haors, bills and low land. These water reservoirs contain weeds, fishes, snails, insects, fallen grains etc which are important feeds for ducks when reared under scavenging and semi scavenging

systems. These feeds are rich sources of protein, minerals and vitamins that help meeting different types of nutrient requirements needed by ducks and increasing their productivity. Total national supply of duck eggs is 73.03 million, 80 percent of which comes from the haor districts. However, the availability of natural feed resources is affected by their habitats, the waterlogged areas that vary according to seasons of the year and regions of the country [13]. Scavenging feed has low nutrient content especially deficient in protein, energy and sometimes calcium for but high in fiber [1]. Only scavenging cannot fulfill the nutritional requirements of growing and productive ducks. It also appears that supplementary feeding is necessary for maintaining optimum production. Supplementation in the form of rice polish, broken rice, soybean meal, maize or lime stone may be used in duck ration.

Before proposing any program for the improvement of feeding of a duck production unit, it is essential to know the existing status of nutrients obtained by the scavenging ducklings. The task of improving the nutritional status of scavenging ducklings is difficult because the quantity and quality of the scavenged feed is not known definitely [18]. Previous efforts to determine nutritional status of scavenging birds were mostly directed for chicken [11]. There is a lack of information on the availability and nutritional status of scavenging ducklings in the haor areas of Sylhet. So, the present experiment was undertaken to assess the physical and chemical composition of feeds available in gizzard of ducklings reared with supplemented feed and under scavenging condition separately, in order to estimate the nutritional value of the supplemented and scavenged feed.

Materials and Methods

Study area

The experiment was conducted for a period between July 2018 and December 2018 in haor areas of Sylhet viz., Haripur in Jaintiapur upazilla of Sylhet and Rasolpur in Sunamganj district.

Experimental design and treatments

A total of 240 Jinding ducks were considered for the feeding trial, among them 150 growers were reared on Haripur, Sylhet Bangldaesh. These ducks were randomly assigned to 3 treatment groups (T1, T2 and T3) containing 50 birds in each group. Again, 90 layers were reared on on Rasolpur, Sunamgonj, Bangladesh. These ducks were randomly assigned to 3 treatment groups (T1, T2 and T3) containing 30 birds in each group. The bird of T1 group received feed only from scavenging, T2 group received 25g supplemented feed in addition with scavenging and the T3 group received 50g supplemented feed with scavenging. The experimental birds were allowed to scavenge freely in the agricultural fields, ponds and ditches near to farmer's house for 9 hours (8.00 A.M. to 5.00 P.M.). Among these treatments 10 layers were collected in July, 2018 and 6 growers in December, 2018 for collection of crop and gizzard contents.

Diets and feeding

Scavenging ducks feed grain, cooked rice, rice husk, broken rice, fruits, feather, piece of brick, sand, stone, unidentified ingredients and different kinds of snails, fish, frog, pests, water hyacinth etc from water body. A supplementary diet was prepared using corn, rice polish, maize, lime stone, wheat bran, meat meal, soybean meal, mustard oil cake, common salt, vitamin-mineral premix, oyster shell and soybean oil well mixed and supplied to the ducks. The ingredients of supplementary diet were given on table 1.

Ingredient (Kg)	Duck growers	Duck layers
Maize	48.21	52
Rice polish	21.25	13.93
Soybean meal	25	20
Meat and bone meal	2	2
Soybean oil	0	8.5
DCP	2	2
Methionine	0.22	0.2
Lysine	0.2	0.1
Nacl	0.22	0.22
Na bicarbonate	0.24	0.24
Lime stone	0.06	0.6
Vit. mineral premix	0.025	0.25
Phytase	0.02	0.02
Toxin binder	0.02	0.02
Total	100	100

Table 1: Proportion of different feed ingredients (g/kg) used in ration formulation.

Sampling and preparation of samples

Sampling was done twice, the first time during Rainy season (July 2018), six grower Jinding ducks were collected from Haripur and the second during winter season (December 2018), ten layer Jinding ducks were collected from Rasolpur.

The birds were collected directly from the farmers in the evening between 5.00 p.m. and 7.00 p.m., when the birds were at the end of the day's scavenging. They were slaughtered on the spot by cutting at the cervical region. Ducks were then brought to, Poultry Science Laboratory, SAU, Sylhet. Each bird was eviscerated, its gizzard was opened and the feed items found in the gizzard were collected and weighed. All samples were kept in the freezer until preparation. Then the collected samples were shifted to Biochemistry laboratory of SAU for nutritional analysis. After taking out the previously weighed contents of gizzard from the freezer, samples were dried at 80 for 72 hours. The dried feed samples of gizzard contents were broken into small fragments and kept separately in air-tight sample bottle.

Nutritional evaluation of the gizzard contents

Unlike chickens, ducks have a spindle-shaped widening of the esophagus, the enlarged diverticulum of the esophagus in the duck lacks definite musculature for the control of feed passage (entry into and exit therefrom); and thus there is no true crop in the duck. The pseudo-crop in the duck serves as a temporary storage organ for lubrication and softening of feed [3]. So, in this experiment, only gizzard contents were analysed for proximate components of dry matter (DM), crude protein (CP), ether extract (EE), and ashes, according to Khan [8].

Determination of dry matter

Crucibles were taken from desiccators was marked at the bottom with pencil for identification and weighed the empty crucible. Gizzard contents were taken on these crucibles and again weighed the crucible with sample. The sample plus crucibles were dried at 80 for 72 hours in hot air oven. The crucibles were transferred to desiccators for cooling. After cooling, the dried sample plus crucible were weighed again.

Determination of ether extract

Ether extract or crude fat was evaluated with Soxhlet apparatus. At first, boiling flask was dried in oven at 105 for 2 hours and cooled on desiccators. The flask then weighed and labeled. Then the condenser was made ready to use by fixing it with the water inlet and outlet pipes. Two gram of grounded and dried sample was taken to a thimble. A piece of cotton wool was placed and lightly pushed on the thimble. The thimble was placed in the soxhlet extractor and connected with round bottom flask. Then, 150 ml diethyl ether was poured inside the extractor through its upper opening. The boiling flask was loaded on the heating unit and by the same time previously ready condenser was fixed with the upper opening of the extractor. Heater and water switches were turned on and the diethyl ether was boiled. The heater regulator was adjusted so that 2 - 3 drops per second of diethyl ether dribbled from the condenser to the boiling flask. The extraction process was continued for several hours, almost 3 hours. The boiling flask was removed from the extraction unit. The ether inside the flask was allowed to evaporate. Then the flask was allowed to cool in desiccator and weighed. Ether extract on a gizzard feed sample was calculated.

Determination of ash

At first, empty crucible was weighed. The dried sample was taken on crucible and weighed the crucible with sample. The crucible plus sample were transferred on muffle furnace at 550 for 5 hours. After five hours the muffle furnace was switched off, but crucible were kept inside the muffle furnace for at least three hours for primary cooling. Then, the crucible with ash was transferred into desiccator to become cool. The crucible with burn sample was weighed carefully. Ash in each sample was calculated.

Determination of crude protein

Crude protein was determined by Kjeldahl method. The Kjeldahl method consists of three steps- Digestion, Distillation, and Titration. A catalyst was prepared by mixing 10g $CuSO_4$, 40g K_2SO_4 with 1g selenium powder; reagent grade concentrated H_2SO_4 was used, 2% boric acid solution was prepared by taking 10g of boric acid on a 500 ml volumetric flask and adding upto 500 ml distilled water on it, mixed indicator was prepared by adding 0.3125g methyl red and 0.2062g methylene blue in 250 ml of 95% ethanol and storing for 24 hours, NaOH 40% solution was prepared by putting 400g of NaOH on a 1 liter volumetric flask and adding upto 1 liter of distilled water on it, Zinc metallic granule was used, HCl 0.1N was prepared by adding 4.95 ml of 37% HCl in up to 500 ml of distilled water in a 500ml volumetric flask.

A 0.5g of prepared sample was transferred on a nitrogen free paper to the Kjeldhal digestion flask. Catalyst powder (3 - 4g) and 25 ml of conc. H_2SO_4 were added to the flask. Then the flask was connected to fume trap and attached to the pump. The heater was turned on and gradually increased the temperature up to 200. The ventilator fan attached with the digestion chamber was turned on immediately after starting heat. Sample was allowed to digest for one hour, until a clear solution (clear green) without black particles was obtained. Then the sample was cooled for 15 minutes, the digestion step is completed.

Sample was dissolved in a minimum amount of ammonia free distilled water and transferred to a kjeldhal distillation apparatus which has been previously conditioned by passing steam for several minutes. 40 mL of NaOH solution was poured to the kjeldhal apparatus. 20 mL of 2% boric acid solution and 1 drop of mixed indicator were added into a conical flask and kept at the end of the apparatus to trap the ammonia liberated. Steam was passed through the flask until about 200 mL of distillate was received. This solution was collected at the conical flask and titrated with standard HCl solution. The endpoint is pink colour. Start and end of the burette reading was recorded. Crude protein present on a sample was calculated.

Microbial evaluation of gizzard contents

Counting of bacterial population from gizzard contents

For counting of microbial population, 7 gm nutrient agar medium was suspended with 250 ml distilled water into a conical flask and boiled with Bunsen burner until the ingredient mixed well. Then the medium was steam sterilized by autoclaving at 15Ibs pressure at 121 temperatures for 15 minutes. Petridishes, glasswares were also sterilized on dry heat oven at 165 for 2hrs. The 20 ml of medium was carefully poured on each petridish and wait until the pour plates have cooled and the agar has hardened. The gizzard content was serially diluted with distilled water from 1 x 10^{-1} to 10^{-10}. About 50 µl (0.05 ml) diluted sample inoculate into a petridish containing nutrient agar medium. Then the sample was spread well with sterilized cotton bud. It was carried out on inside the Laminar Air Flow (LAF) Cabinet. After spreading the petridish was incubated at 37 temperatures for 24 hours. At the end of the incubation period petridish containing between 30 and 300 colonies were selected. Plates with more than 300 colonies cannot be counted and are designated too many to count (TMTC). Plates with fewer than 30 colonies are designated too few to count (TFTC). The bacterial colonies were counted on each plate. The number of bacteria (CFU) per milliliter of sample was calculated by dividing the number of colonies by the dilution factor multiplied by the amount of specimen added to liquefied agar.

Results

Proximate composition of supplemental diet

Supplemental diet which was given on experimental ducks as supplemented feed in addition with scavenging feed in order to increase production performance. The proximate composition of supplemental diet has been shown on table 2.

Nutrient composition (%)	Amount (%)
Crude protein (%)	17.58
Ash (%)	7.35
Crude fiber (%)	3.82
Ether extract (%)	5.86

Table 2: Nutrient composition of supplemental diets.

Growth performance and gizzard contents of ducks

The effects of feeding scavenging and supplementary diets on the growth performance of Jinding ducks has been shown on table 3. The body weight of birds was higher receiving 50g feed supplement in addition with scavenging diets than the other diets. It is also evident that, gizzard weight of duck was higher when feed supplement was added in their diet. The mean gizzard weight was 68, 71 and 76g when given scavenging, 25g feed supplement+ scavenging, 50g feed supplement+ scavenging diet respectively. The mean body weight of experimental ducks were 1096, 1160 and 1287g when feeding on only scavenging, 25 and 50g feed supplement in addition with scavenging respectively. It was observed from table 3 that there was a variation in fresh weight of gizzard contents among feeding regimes. The highest weight of gizzard contents was 23g when taken 50g supplementary feed with scavenging.

Dietary treatment	Body weight (g)	Gizzard weight (g)	Gizzard content (g)
T_1	1093.67 ± 48.85	67.16 ± 6.01	14.33 ± 3.68
T_2	1132.67 ± 107.16	69.76 ± 5.88	21.83 ± 7.79
T_3	1287.33 ± 58.66	74.67 ± 2.49	23 ± 0.82
P value	< 0.01	< 0.01	< 0.01

Table 3: Growth performance of Jinding ducks compared on three dietary treatments (means ± SD, N = 16).

*T_1: No feed supplement; T_2: Scavenging + 25 g/d feed; T_3: Scavenging + 50 g/d feed.

Proximate composition of gizzard contents

There were significant differences (P < 0.01) in proximate composition (DM, Ash, CP, EE) of gizzard contents among different dietary treatment. The mean value of DM in gizzard contents were 55.17% and the overall mean nutrient composition (% of DM) of gizzard contents were 4.71%, 2.55%, and 50.12% for CP, EE and Ash respectively. Data shown on table 4 and 5 revealed that crude protein was higher on gizzard of duck when receiving feed supplement in addition with scavenging. The maximum value of crude protein present in duck gizzard was 6.13% receiving 50g feed supplement + scavenging. The mean value of crude protein was 8.32% during rainy season on the other hand 5.69% during winter season. Results recorded in table 4 and 5 showed that supplementary feed showed significant effect on ether extract and ash content. Ether extract was significantly higher when supplementary feed was given on diet. But the dry matter values of gizzard content were not affected by feed. The ash content was lower when added supplementary feed on diet with scavenging. The mean value of ash (Table 4) was 53%, 47% and 45% when given only scavenging, 25g supplemented feed + scavenging and 50g feed supplement+ scavenging respectively.

Treatment	Dry matter %	Ash content	Ether extract	Crude protein
		% of DM		
T_1	53.47 ± 5.67	52.87 ± 4.67	1.35 ± 0.42	2.19 ± 0.32
T_2	59.21 ± 7.15	46.79 ± 4.56	2.57 ± 0.42	3.75 ± 0.76
T_3	56.17 ± 1.22	45.33 ± 4.1	4.2 ± 0.41	5.69 ± 0.44
P value	< 0.01	< 0.01	< 0.01	< 0.01

Table 4: Proximate composition of gizzard contents of Jinding ducks (1.5 years) during winter season which were collected from Haripur (means ± SD, N = 4/T_1, N = 4/T_2, N = 2/T_3).

T_1: No feed supplement; T_2: Scavenging+ 25g/d feed; T_3: Scavenging+ 50g/d feed.

Treatment	Dry matter %	Ash content	Ether extract	Crude protein
		% of DM		
T1	57.58 ± 6.78	53.98 ± 5.335	1.46 ± 0.09	2.81 ± 0.17
T2	54.35 ± 0.895	49.3 ± 8.01	2.21 ± 0.32	5.51 ± 0.26
T3	50.24 ± 0.99	46.475 ± 3.175	3.58 ± 0.17	8.31 ± 0.43
P value	< 0.01	< 0.01	< 0.01	< 0.01

Table 5: Proximate composition of gizzard contents of Jinding ducks (12 week) during rainy season which were collected from Rasolpur (means SD, N=2/ treatment).

*T_1: No feed supplement; T_2: Scavenging+ 25 g/d feed; T_3: Scavenging + 50 g/d feed.

Total bacterial count from gizzard contents

The number of bacteria (CFU) of the gizzard contents was around 10^3 - 10^6/ml. The number of bacteria (CFU) was 10^4 - 10^6/ml when duck receiving only scavenging on their diet. Bacteria were present in 10^3 -10^4/ml (CFU) on gizzard contents when given supplementary diet in addition with scavenging (Figure 1). The total bacterial count from gizzard contents of duck has been given on table 6.

Sample	Type of feed	Type of bacteria	Total no.
S_1	Scavenging	Total count	1.2×10^4/ml
S_2			1.28×10^6/ml
S_3			9.0×10^4/ml
S_4			1.16×10^5/ml
S_{11}	25g/d feed supplement + scavenging	Total count	1.8×10^4/ml
S_{12}			1.48×10^4/ml
S_{13}			1.52×10^4/ml
S_{14}			1.10×10^4/ml
D_1	50g/d feed supplement+ scavenging	Total count	7.2×10^3/ml
D_2			5.06×10^4/ml

Table 6: *Total bacterial count from gizzard contents of ducks based on different dietary treatment.*

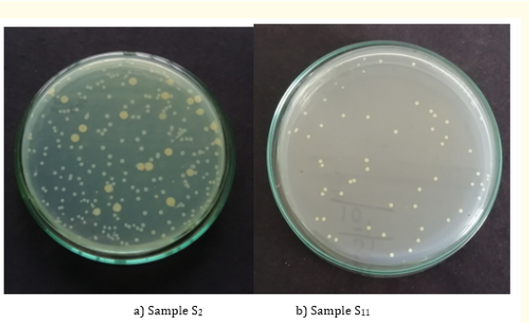

Figure 1: *Bacterial colony from gizzard contents of ducks*

Discussion

Supplementary feed containing 17% protein that is required for increasing body weight and growth rate of ducks. It was evident that higher body weight was achieved might be due to high consumption of supplementary diet. Miah., *et al.* [9] reported that indigenous grow-

ing chicks of Bangladesh require 17% protein density in the diet to optimize feed intake and growth rate. The weight of gizzard contents was higher when ducks consume large amount of supplementary diet in addition with scavenging diet. Rashid., *et al.* [17] reported similar results as that higher weight of dry crop contents during harvesting season might be due to the large consumption of whole paddy rice harvested in this season.

The amount of CP on gizzard content was very low which might due to presence of hydrochloric acid and proteolytic enzymes such as trypsin, chymotrypsin, and elastase on gizzard by which protein is digested. Crude protein was higher on gizzard of ducks when receiving feed supplement in addition with scavenging because supplementary diet containing high amount of protein. The maximum value of crude protein of duck was 8.31% receiving 50g feed supplement+ scavenging (Table 4). It was also evident that crude protein was higher during the rainy season than winter season (Figure 2) due to greater consumption of protein rich food. Islam., *et al.* [7] reported that during the rainy and autumn season, water surrounds the localities and natural feeds like different kinds of snails, fish, pests, weeds, earthworm and water hyacinth become available and these feeds are rich sources of protein, minerals and vitamins. Data shown on table 4 and 5 revealed that crude protein content was higher in younger birds than adult. This finding was closely associated with the works of Rahman., *et al.* [15] who found crude protein was higher at 6 weeks age than at 10 and 14 weeks of age.

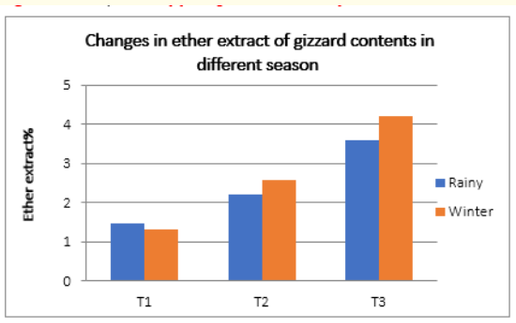

Figure 2: *Changes in ether extract of gizzard contents in different season (T1: No feed supplement, T2: Scavenging + 25 g/d feed, T3: Scavenging + 50 g/d feed).*

Ether extract of gizzard contents was significantly higher when supplementary feed was given on diet than only scavenging diet. The mean value of EE (4.2%) was higher on duck receiving 50g supplementary feed + scavenging than other diet. These findings were in agreement with the works of Rahman., *et al* [15]. Figure 3 revealed that season had no effect on ether extract. This finding was in agreement with Huque., *et al.* [6] who reported same results that levels of ether extract were low in all locations and seasons with no obvious trends among them.

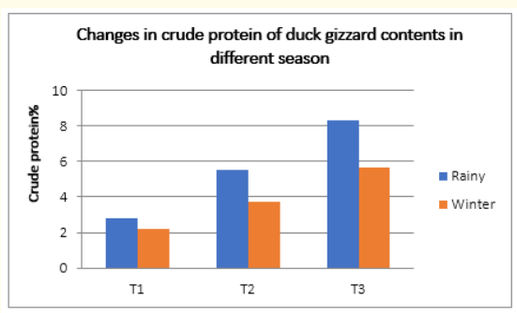

Figure 3: *Changes in crude protein of gizzard contents in different season (T1: No feed supplement, T2: Scavenging + 25 g/d feed, T3: Scavenging + 50 g/d feed).*

Ash contents were higher than other nutrient contents because gizzard contains hard objects such as sand or grit. The crude ash content was lower when supplementary feed was given on diet. The highest amount of ash was 53% when feed supplement was not given. These findings were in agreement with the works of Rahman., *et al* [15]. The crude ash was higher during rainy season than winter season (Figure 4). Data shown on table 4 and 5 revealed that ash content of gizzard contents was lower at older age than that found in case of younger birds being in agreement with the findings of Rahman., *et al* [15]. It was also evident that the dry matter values of gizzard contents were not affected by supplemental feed (Table 4) and seasonal variance (Figure 5) these findings were in agreement with the findings of Rahman., *et al* [15].

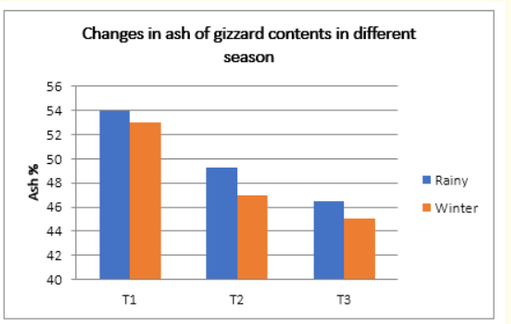

Figure 4: *Changes in ash content of gizzard contents in different season (T1: No feed supplement, T2: Scavenging + 25 g/d feed, T3: Scavenging + 50 g/d feed).*

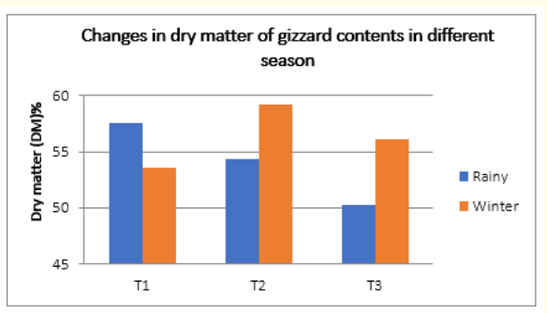

Figure 5: *Changes in dry matter of gizzard contents in different season (T1: No feed supplement, T2: Scavenging + 25 g/d feed, T3: Scavenging + 50 g/d feed).*

Data shown on table 6 revealed that the number of microbes was low in gizzard content that might be due to presence of gastric juices, pepsin, and hydrochloric acid in the gizzard, which acidifies the medium, resulting in lower bacterial and less fermentation activity. It was evident that the number of microbes was lower when 50g supplementary feed was given on diet (Table 6). Wei., *et al.* [22] reported that increased dietary energy level reduced the diversity of duck intestinal microbiota and low dietary energy content may reduce the defense of duck.

From the present results it can be assumed that the scavenging feed resource was deficient in crude protein and crude fat content when taking the recommended level of chicken diets by Payne [14] and NRC [12] into consideration. When supplementary feed was supplied with scavenging, the nutrient content was higher. Thus, supplementary feed is required to express the performance potentiality of ducks in the rural areas of Sylhet. Rainy season expectedly increased the amount of nutrients (Crude Protein) in gizzard contents compared to winter season. So, supplementary feed is required in high amount during winter season than rainy season as available of feed is lower in winter than rainy season.

Conclusion

The analysis of nutrient composition of gizzard contents of duck was not satisfactory result due to presnce of pepsin and hydrochloric acid on gizzard that denature the proteins. In addition sand, small stones, snails were present in gizzard content, so that ash content was higher than normal range. So it is not possible to find out the accurate nutrient status of feed by analysis of gizzard content. It could be better to study the analysis of feed sample from proventiculus and esophagus. From the present result it can be concluded that ducks only scavenging is not enough for them, they should be supplied at least 50g of supplemented feed. In future research cost benefit analysis should be carried out.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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