**Chapter-1**

**Introduction**

The poultry sub-sector is an important avenue in fostering agricultural growth and reduce malnutrition for the people in Bangladesh (**Akbar *et al*., 2013**). It is an integral part of farming system in Bangladesh and has created direct, indirect employment opportunity including support services for about 6 million people (**Chowdhury *et al*., 2011**). The major ingredients in poultry diets provide the protein and energy required for poultry to maintain health, grow, and produce eggs. However, the high price and non-availability of feed ingredients are two major constraints to the growth of commercial poultry enterprises. In Bangladesh, feed cost alone accounts 60-70% of the total production cost (**Bulbul and Hossain, 1989**). Therefore, it is important to explore quality feedstuff to enhance optimum productivity. About 80% feed stuffs used in poultry ration are imported from different countries. As a result, the cost of feed prepared for poultry using those grains are always high. (**Hossain *et al*., 2016**). Broiler starter is in the small granule size which makes easy for the chicks to pick up the feed faster. Starter feed is designed in a very precise manner for healthy growth of the chick which carries high immunity to face the possible stresses like diseases, climate variation, vaccinations, handling etc. A bird requires 1 Kg. of starter feed to shift to finisher feed Rational balance of all required nutrients is maintained in this feed so as to get faster & maximum weight gain. Broiler Starter feeds are given to the chicks for 0-14 days of age. Broiler starter feed should contain proper amount of moisture, ME, CP, CF, Ca, P etc. The standard requirements of moisture, ME, CP, EE, CF, Ca and P should be 12%, 3000 kcal/kg, 22%, 5.5%, 4.5%, 1% and 0.5% respectively.

**Broiler Grower feed** is a complete feed for all growing broiler chicks.  This feed is in a granular form that makes it easy for the small chicks to consume.  A natural fungal-based (dried Aspergillus niger fermentation product) enzyme pack to aid in the break-down of the different components of the diet.  Enzymes include amylase, β-glucanase, cellulose, pectinase, xylanase, phytase, and protease. A balanced amino acid profile of Lysine, Methionine, and Cystine.  These amino acids are needed to support the dynamic turn-over and growth of structural (bones, ligaments, and muscles) and protective (skin and feathers) tissues in the bird.Elevated Choline (a B-vitamin) which aids in fat metabolism, supports cognitive function, and serves as an anti-inflammatory agent. The nutrient composition of Broiler grower feed proper balance of Metabolic energy, moisture, crude protein, crude fiber, ether extract, methionune, lysine, calcium, available phosphorus respectively 3100 Kcal/kg, 12%, 21%, 4.5%, 6%, 0.45%, 1.1%, 0.9%, 0.45% respectively and it given to broiler from 15 days to 28 days .There is some variation in different broiler grower feed among different commercial feed companies.

This unusual variation in the composition of Broiler starter feeds makes a complex situation for the formulation of practical ration. Therefore, current study was conducted to find out the following objectives:

* To ascertain the nutrient status of compound broiler starter and grower feeds produced in three different feed mills in Bangladesh
* To compare between the company standard value and the actual value of nutrients in the ration of broiler grower in different companies.
* To explore the quality of compound Broiler feeds on the basis of laboratory analysis.
* To suggest the best poultry feed producing company following standard value.

**Chapter-2**

**MATERIALS AND METHODS**

**3.1. Study Area**

Three feed mills engaged in production were selected to collect feeds during study period from September to October, 2017. These feed mills are located scatteredly in different parts of Bangladesh. Many broiler farms in Chittagong use feed from these mills. Therefore, these broiler farms were selected as the study area for collection of sample.

**3.2. Collection of Sample**

Samples were collected by using simple random sampling technique. Several physical characteristics were seen during collection. The feed samples were brownish color with good flavor, free from foreign particles (soil, dust, weeds, iron, nails etc.) and no offensive odor was present. Samples were wrapped by polythene bags and preserved in the laboratory for chemical analysis.

**3.3. Preparation of sample**

The feed samples were ground by using micro-grinder to make it homogenous powder. Later on, it was mixed properly and exposed to shade to cool down for sampling.

**3.4. Determination of nutrients content of feed sample**

Proximate analysis of feed samples was carried out to see the different nutrient level like moisture, dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extracts (NFE), ether extracts (EE) and ash in Poultry Research and Training Centre (PRTC) laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh.

**3.4.1. Determination of Moisture**

Moisture percentage was determined after determination of DM (dry matter).The enamel disc or crucible was dried in an oven regulated at 105°C which was cooled in a dessicator & weighted. 5gm of feed sample was weighted into the enamel disc and kept into the oven (105°C) for 24 hours. The enamel disc was removed from the oven with metal tong. After that it was cooled in dessicator and the final weight was taken after getting constant weight **AOAC, (1990).**

 % Moisture = 100 - % DM

**3.4.2. Determination of Ash**

The crucible was cleaned & dried in hot air oven. Than it was cooled in dessicator and weighted. 5 grams of feed sample was placed there and the sample was burned upto no smoke in heater. The crucible with sample was cooled & transferred to the muffle furnace. Then the sample was ignited at 550-600°C for 6-8 hours until white ash. The furnace was cooled at 150°C & the sample was transferred to dessicator and weighted **AOAC, (1990).**

**3.4.3. Determination of Crude fiber (CF)**

Two gram feed sample was weighted and taken into a beaker. 125ml of 1.25% H₂SO₄ was added into the beaker. Than it wasfitted in condenser and placed on heater**.** The beaker was boiled for 30 minutes and removed from heater. After that it wascooled and filtered through filtering cloth. The sample was washed until it was free from acid. Residue of sample was transferred into same beaker. 125ml of 1.25% NaOH was added there and again fitted in condenser and placed on heater. It was boiled for 30 minutes and removed from heater which was cooled and filtered through filtering cloth. The sample was washed until it was free from alkali. Then residue of sample was transferred in a previously weighted crucible. The crucible was put into the muffle furnace & ignited at 600°C temp. for 5 hours. Then it was weighted after cooling.

**3.4.4. Determination of Crude protein (CP)**

0.5 gram sample was weighted and one spoonful catalyzer mixture (KOH, NaOH, Se) was added there.10ml Conc. H₂SO₄ was added and the digestion flask was placed in Kzeldhal Digestion Set. After that heat was increased gradually & continued upto clear residue(45 min-1hr).The Flask was removed & cooled.10ml 2%Boric Acid solution and 2 drops mixed indicator was taken in a conical flask. The conical flask was fitted in the collection arm of distillation set. 50ml distilled H₂O was added in the digestion tube and fitted in the distillation flask.40ml of 40%NaOH was added there & the distillation was continued upto 100ml of distillate.The Distillate was titrated against 0.1N HCl. Titration was continued until the color changed into pink. Then the Titration volume was calculated **AOAC,(1990).**

**3.4.5. Determination of Ether extracts (EE)**

One gram dry sample was taken in an extraction thimble having porocity then placed in the soxhlet flask. The cork of thimble was above the syphone tube. A receiving flask was weighted and fitted with soxhlet apparatus and was placed in water bath(50-60°C). Ether Extract was poured down into the soxhlet flask. The flask under soxhlet was full upto 3/4th portion with ether and was sured that water was running through the condenser. When extraction was over, the thimble with sample was removed and heated in the water bath to remove all the ether from receiving flask. The receiving flask was placed into the oven (105°C) to eliminate left of the ether and water. After drying, the flask was taken out and weighted **AOAC, (1990).**

**3.4.6. Calculation of Nitrogen free extracts (NFE)**

The NFE content was calculated by deducting the sum of the values for moisture, crude protein, crude fat, crude fibre and total mineral matter in 100 **Raghuramulu *et al*.,** **(1983 ).**

**3.4.7. Metabolizable energy (ME)**

The metabolizable energy content was calculated by using the following formula **Lodhi *et al.,(1*976).**

 ME = 32.959 (% CP + % EE × 2.25 +% NFE) - 29.

**3.5 Statistical analysis**

Data related to chemical composition of Broiler starter and grower were compiled by using Microsoft Excel 2007. Chi-square (χ²) test was performed to analyze the data by using SPSS 16.0**.** Statistical significance was accepted at 5 % level.

**Chapter-3**

**RESULTS AND DISCUSSION**

**Variation of nutrient contents in compound poultry feed:**

The chemical compositions of the feed samples of three different feed mills are shown in table 1. Reference values for nutrients of broiler starter and grower feeds recommended by different researchers are shown in table 2 and Table 3. The information regarding the levels of nutrients in feeds as claimed by different companies and analytical levels are shown simultaneously for comparison. For convenience of better presentation, the quality of a feed with respect to its nutrient contents, the analytical values of nutrients of different feed mills are also discussed in graphical representation.

**Variation of nutrients in feeds of broiler starter and grower of three different feed mills**

Chemical composition of broiler starter and grower mash feed millers company particularly moisture, crude protein (CP), crude fiber (CF), Ether extracts (EE), ash contents have been presented in table 1

**Table 1:** **Chemical composition (g/100gDM) of broiler starter and grower feeds from different feed mills**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Name of the company** | **Feed type** | **Moisture** | **ME** | **CP** | **CF** | **EE** | **Ash** |
| Nahar | Starter | 12 | 2950 | 21.8 | 3.25 | 5.4 | 5.9 |
| Grower | 12 | 3050 | 20.3 | 4.7 | 6 | 5.5 |
| Provita | Starter | 11.50 | 2650 | 20 | 4 | 4.5 | 5.4 |
| Grower | 12 | 2680 | 19 | 4.3 | 5 | 5.3 |
| Nourish | Starter | 15 | 2900 | 21.3 | 5.5 | 6 | 5.8 |
| Grower | 16 | 3000 | 19.1 | 5.9 | 6.5 | 5.6 |
| Level of significance | NS | NS | NS | NS | NS | NS |

NSNon significance (P>0.05); MEMetabolic Energy (Kcal/kg); DMDry matter; CPCrude protein ; CFCrude fiber; NFENitrogen free extract; EEEther extract

**Table 2: Reference values for nutrients of broiler starter feeds recommended by different researchers**

|  |
| --- |
| Nutrient contents (g/100g) |
| Investigators | DM | CP | CF | EE | TA | Ca | P |
| **Roy *et al*., 2004** |  |  |  |  |  |  |  |
|  Aftab feed | 89.7±0.85 | 23.9±2.48 | 4.70±0.66 | 6.70±1.71 | - | 1.30±0.14 | 0.50±0.10 |
|  Quality feed | 89.8±0.89 | 23.5±1.10 | 6.40±1.56 | 5.30±0.78 | - | 1.46±0.06 | 0.40±0.27 |
|  Paragon feed | 89.2±0.82 | 22.2±0.41 | 5.80±0.06 | 7.10±0.35 | - | 1.30±0.19 | 0.50±0.05 |
|  Nourish feed | 90.0±1.09 | 22.9±1.37 | 3.50±0.52 | 5.40±0.93 | - | 1.10±0.11 | 0.50±0.06 |
| **Vakili et al., 2015** | 90.45 | 23.59 | 4.77 | - | 6.33 | 1.05 | 0.62 |
| **Khan *et al*., 2008** | 88.05±1.3 | 21.17±0.1 | 4.1 | 9.31±0.21 | 6.85 | 1.02±0.05 | - |

**Table 3: Reference values for nutrients of broiler grower feeds recommended by different researchers**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **References** | **Moisture (%)** | **ME (Kcal/kg)** | **CP (%)** | **CF (%)** | **EE (%)** | **Ca (%)** | **P (%)** |
| Larbier, M. and Leclerc, B. (1992) | 12 | 2750-2900 | 16-17 | 4 | 3.5-4 | 3.5 | 0.4 |
| Banarjee, G.C.(1995) | 10 | 2700 | 18 | 8 | - | 2.75 | 0.5 |
| Verma D. N. (2006) | - | 2700 | 18 | - | - | 3 | 0.45 |

**Comparative study of nutrient concentrations of broiler starter and grower feeds of different feed mills:**

**Table 4: feed company report and analytical report of Nahar**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **nutrients** | **Feed company report(starter)** | **Analytical report(starter)** | **Feed company report(grower)** | **Analytical report(grower)** |
| Moisture% | 12 | 11 | 12 | 11 |
| ME(kcal/kg) | 2900 | 2950 | 3100 | 3050 |
| CP% | 22 | 21.8 | 21 | 20.3 |
| CF% | 3.5 | 3.25 | 5 | 4.7 |
| EE% | 5.5 | 5.4 | 5.5 | 6 |

Source of company report: specification attached with the collected feed bag

All the chemical compositions found by the Nahar broiler starter and grower feed i.e. ME, CP, EE, CF contents were very similar between company recommended value and analytical value . This company followed the standard level.

**Table 5: feed company report and analytical report of Provita**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **nutrients** | **Feed company report(starter)** | **Analytical report(starter)** | **Feed company report(grower)** | **Analytical report(grower)** |
| Moisture% | 11 | 11.50 | 12 | 12 |
| ME(kcal/kg) | 2900 | 2650 | 3000 | 2680 |
| CP% | 21.5 | 20 | 20.5 | 19 |
| CF% | 3.9 | 4 | 4 | 4.3 |
| EE% | 4.5 | 4.5 | 5.5 | 5 |

Source of company report: specification attached with the collected feed bag

Observation on the nutrient concentrations of Provita broiler starter and grower feeds showed that ME and CP contents were found lower in comparison to those shown by the feed company which are important ingredients in broiler ration. The company value of moisture, CF and EE were almost similar to analytical value and standard value

**Table 6: feed company report and analytical report of Nourish**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Nutrients** | **Feed company report(starter)** | **Analytical report(starter)** | **Feed company report(grower)** | **Analytical report(grower)** |
| Moisture% | 12 | 15 | 12 | 16 |
| ME(kcal/kg) | 2950 | 2900 | 3050 | 3000 |
| CP% | 21 | 21.3 | 20 | 19.1 |
| CF% | 4 | 5.5 | 3.9 | 5.9 |
| EE% | 5 | 6 | 5.5 | 6.5 |

 Source of company report: specification attached with the collected feed bag

In case of Nourish broiler starter and grower feed the moisture, CF and EE were found higher in comparison to those shown by the feed company. The ME and CP of company value were considerable according to standard value.

**Variation in Nutritional composition of broiler starter and grower feeds of different feed mills (Graphical presentation)**

**Metabolizable energy:** Metabolizable energy(kcal/kg) is higher provided by Nahar Company which are 2950kcal/kg(Starter) and 3050kcal/kg(grower). Nourish company provides 2900kcal/kg(starter) and 3000kcal/kg(grower). But the standard level are 2950-3000kcal/kg(starter) and 2750-2900kcal/kg(grower) **Larbier and Leclerc, (1992)**

Fig 2: ME (Kcal/kg) of broiler grower feeds of different feed mills

Fig 1: ME (Kcal/kg) of broiler starter feeds of different feed mills

**Crude protein (%):** Provita company provide less crude protein than Nahar and Nourish. But all the company followed the standard value. The standard level of crude protein is 19-20% **Labier and Leclerc, (1992)**

Fig 3: CP% of broiler starter feeds of different feed mills

Fig 4: CP% of broiler grower feeds of different feed mills

**Moisture(%):** The moisture percentage was higher in Nourish company than Nahar and Provita company. The standard level of moisture is 12% in both Starter and grower feed.

Fig 6: Moisture% of broiler grower feeds of different feed mills

Fig 5: Moisture% of broiler starter feeds of different feed mills

**Crude fiber (%):** Nahar and Provita provide crude fiber almost similar to standard level but Nourish provide little higher crude fiber than the standard level. The standard level of crude fiber is 5% **Labier and Leclerc, (1992)**

Fig 7: CF% of broiler starter feeds of different feed mills

Fig 8: CF% of broiler starter feeds of different feed mills

**Ether extract (%):** Nahar and Provita and Nourish all three company provide higher level of EE where as the standard level is 3-3.5% **Labier and Leclerc, (1992)**

Fig 7: EE% of broiler grower feeds of different feed mills

Fig 7: EE% of broiler starter feeds of different feed mills

**Chapter-4**

**Limitations of the Study**

* In this proximate analysis, we estimated total N2, not the ultimate protein & NPN (Non Protein Nitrogenous Substance).
* Again it was estimated %CP from N2 multiplying by 6.25 assuming that all protein contains 14-18% N2. So over & under estimation of N2 can be happened.
* During estimation of %CF, acid & alkali boiling is going on the hemicelluloses was partially destroyed. So there can be a little variation from the real value of %CF.
* We couldn’t estimate vitamins, calcium and phosphorus level of feed by using this method.
* Any deviation in results may be due to environmental or experimental error.
* The study area was also limited.
* It was not all possible to get economic data from record sheet of those farms exactly because most interviews were done over phone call. So some deviation from exact data was occurred.

**Chapter-5**

**Conclusion and Recommendation**

Broiler starter feed is very important for broiler at the age of 0-14 days. It can enhance the growth of broiler. It contains all types of nutrients for betterment of growth of broiler. There is no doubt that, inclusion of broiler starter feed will substantially minimize cost of production for broiler. However, current study indicates that the quality of broiler starter feed is slightly variable. On the other hand broiler grower feed is very vital type feed during the growing stage of broiler chicks. It contains all types of necessary nutrients in pellet form for broiler chicks and it is easily digested. However, current study indicates that the quality of broiler grower feed is slightly variable. Therefore, to formulate least cost balanced ration, broiler starter and grower feed must be analyzed first in the laboratory and then incorporate it into the practical ration.

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