Evaluation of Concentrate Feeds Used in Beef Cattle and Lactating Cows Manufactured by Different Feed Industries

A THESIS

BY

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Abstract

The study was conducted to evaluate the nutritional quality and to compare manufactured feeds for beef cattle and milch cow supplied feed industries of Bangladesh. The experiment was conducted with seven treatments, T_0=Calculated value (Standard), T_1=Company 1, T_2=Company 2, T_3=Company 3, T_4=Company 4, T_5=Company 5, T_6=Company 6 having three replications. The feeds for beef cattle and milch cow collected from local animal feed sale points of Khulna district. After collecting the material, they were ground into fine particles using an electrical grinder and the sample were dried in the oven for 24 hours at a temperature of 105°C to measure dry matter. The remaining samples were kept in dry, well-covered containers until they were analyzed. Proximate analysis of feed samples was carried out in Animal Husbandry Laboratory of Agrotechnology Discipline, Khulna University. In case of feed for milk production, highest DM was 90.19% in T_3 while the lowest DM of milk production feed was 84.10% in T_5 and the calculated standard value (T_0) was 86.00%. DM% was not significantly ($p>0.05$) affected while comparing company feeds for milk production feed with standard calculated value. Highest CP% was obtained in T_1 (12.78%) and the lowest was found in T_2 (7.47%) in company feeds and the calculated standard value (T_0) was 19.00% which highly differed significantly ($p<0.001$). Highest GE was obtained in T_6 (399.77) kcal/kg and the lowest was found in T_5 (211.1)kcal/kg in company feeds and the calculated standard value (T_0) was 338.28kcal/kg. Highest TDN% was obtained in T_1 (67.96%) and the lowest was found in T_6 (54.97%) in company feeds and the calculated standard value (T_0) was 87.82% which was significantly ($p<0.05$) differed. In case of feed for beef fattening, highest DM was 89.85% in T_3 while the lowest DM of beef fattening feed was 88.81% in T_2 and the calculated standard value (T_0) was 86% DM%. Highest CP% was obtained in T_3 (10.76%) and the lowest was found in T_1 (7.64%) in company feeds and the calculated standard value (T_0) was 10%. The highest GE was obtained in T_3 (289.25) kcal/kg and the lowest was found in T_6 (236.12)kcal/kg in company feeds and the calculated standard value (T_0) was 333.40 kcal/kg. The highest TDN % was obtained in T_1 (70.47%) and the lowest was found in T_6 (60.09%) in company feeds and the calculated standard value (T_0) was 88.63% which was significantly ($p<0.05$) differed. It may be concluded that the investigated feeds collected from different locations of Khulna division are inconsistent among analysis value, packet value and lower in nutrient composition when compared to standard calculated value.

Chapter 1

Introduction

1.1. Background of the study

Animal feed is the most important component in the production of animal proteins. In Bangladesh, livestock sector is one of the major components of agricultural activities and plays a crucial role in economic development by ensuring food security and stimulating the growth of a number of subsidiary industries (Goutam et al., 2017). Approximately 64% of the livestock farmers practice fattening round the year and rest of the farmers followe fattening for period of 3 months like before Eid-ul-Adha (Kamal et al., 2019).

Bangladesh is the fifth largest producer of feed but its share of the global feed market is merely 1.5%.The annual demand for animal feed in Bangladesh is around 6.3-6.4 million tonnes; production in 2020 surpassed the demand, industry people say. In that year, total commercial feed production reached 6.57 million tonnes. Of that, poultry feed production was 4.45 million tonnes, fish feed 1.59 million tonnes and cattle feed were 0.53 million tonnes. The feed industry has witnessed a 161% jump in production over the last seven years. The poultry sector consumes 62.9% of feed, cattle 14% and fish 23% (Islam and Ali, 2021).

Feed shortage is the main reason for low productivity of livestock in Bangladesh (Rahman et al., 1998; Baset et al., 2003; Jahan et al., 2018) and at the same time farmers are not able to formulate a balanced ration leading to loss of productivity. To fulfill the requirement of farmer for concentrate feed, commercial feed industries are marketing the branded feeds to cater the market demand. Ideally the role of these industries should be to provide high quality livestock feeds to enhance production by meeting the nutrient requirements of livestock in different stages of growth or production. A question arises whether the animal feed industries maintain the composition accurately in the feed as mentioned in the bags and the feed is free from harmful objects or they attempt to mislead the consumer. Misleading information in the nutritional profile of feed provided by the suppliers erodes the consumer confidence and loss of

productivity. The farmers are faced with multiple challenges regarding the poor and inconsistent quality of commercial feeds, limited capital, and insufficient knowledge of nutritive value of commercial feeds (Laswai and Nandonde, 2013). Commercial feed producers tend to sell their feed by exaggerating the nutritional profile of the feed leading to poor production performance of livestock and loss to the farmers. This practice challenges the reliability of commercial feed quality besides effecting the safety of feed in cattle.

Many scientists analyzed the feed quality and, in their analysis, had some deficiency in terms of amount nutrients as well as non-nutrient feed factors. Feed evaluation methods aim to give information on the feeds to meet the nutritional needs of the animal. Therefore, feed evaluation is needed to assess the nutritional value among feeds. The methods to express the feed value incline to measure mainly digestibility of the feedstuff. Many feed evaluation methods have been developed and modified over the years to predict the nutritional component of the feed. The nutritive value of ruminant feeds is assessed by the chemical composition, concentration and rate and extent of digestion of feed in the rumen. Chemical, digestibility and enzymatic methods are the main methods that have been used for feed evaluation.

The present study was designed to investigate the evaluation of nutritive value of concentrate feeds manufactured by different feed industries used in beef cattle and milking cows.

Moreover, this research will find out the quality of manufactured feeds in feed industries of Bangladesh. Current research will lead to better understanding of the chemical composition of the commercial feeds for beef cattle and milch cows. Findings of the present study will help the farmers of Bangladesh in understanding the quality of the purchased commercial feeds leading to better feeding. An ideal combination of ingredients in compounded feed ensures rational use of available resources while meeting the nutritional requirements of the animal. So, the approach of analyzing compounded feed can be an economic attempt for better feed production as well as increasing productivity and nutritional status of livestock.

1.2. Research Gap

i. Insufficient information regarding actual nutritive quality of manufactured live stocks feeds to feed industries in Bangladesh.

ii. Determination the quality of different companies' manufactured feeds in feed industries of Bangladesh has not been much studied.

iii. Comparison between packet and analysis value with the standard or requirements value of milk production and fattening feed has not been much studied.

1.3. Objectives

i. To investigate the quality of manufactured feeds in feed industries of Bangladesh.

ii. To compare the calculated value of nutrient to the labeled value of feeds used for beef cattle and milch cow.

Chapter 2

Literature review

This chapter is designed for critical reviews for comparing past studies about commercial cattle feed quality to the present study. The literature review would help conduct the research in proper way and it brought about the recent information on this field. Under this chapter I have discussed the findings of different researchers related to my study.

2.1. What are commercial feeds for animals?

Commercial feed means all materials or combinations of materials which are distributed or intended for distribution for use as feed or for mixing in feed for animals. It was reported by Carter et al.(2014) that "Commercial feed" means any materials, used singly or in combination, which are distributed, or are intended to be distributed, for use as feed or for mixing in feed.

Md.Siraju Hoque (2022) was reported that according to the Feed Industries Association of Bangladesh (FIAB), there are 96 members. All of them are good quality manufacturers. Here is a list of popular 10 feed companies.

1. ACI Godreg Agrovet Private Limited
2. C.P. Bangladesh Co. Ltd.
3. Nourish Poultry & Hatchery Ltd.
4. Kazi Farms Limited
5. Provita Feed and Hatcheries Ltd
6. Quality Feeds Limited
7. Spectra Hexa Feeds Ltd.
8. Paragon Group
9. Suguna Food and Feeds Bangladesh Private Ltd.
10. Aftab Feed Products Ltd.

2.2. Nutrient composition of commercial feeds

Kamal et al., (2020) investigating the Quality of Commercial Beef Cattle Feeds and Feed Ingredients Used in Bangladesh. Chemical analysis of samples was carried out in triplicate for dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE), ash, acid detergent fiber (ADF) and neutral detergent fiber (NDF) content.

2.3 Importance of milk production

Approximately 150 million households around the globe are engaged in milk production. In most developing countries, milk is produced by smallholders, and milk production contributes to household livelihoods, food security and nutrition. Most recent data available from the FAO shows that the gross production value of agriculture equals 3282 billion USD, whereas that of raw milk produced across the world equals 292 billion USD. On a global scale, the value of milk represented 8.9% of the value of all agricultural products in 2010. In 2019 alone global milk production accounted for 851.8 million tons, meaning an average individual milk consumption of about 111.4kg of milk per person.

According to the FAO (2020), world milk production (roughly 81% cow milk, 15% buffalo milk, and 4% from goat, sheep and camel milk combined) is projected to grow at 1.7% from 2021 to 2030 (faster than most other main agricultural commodities.

2.4 Importance of meat production

Meat is animal flesh that is eaten as food. Humans have hunted, farmed, and scavenged other animals for meat since prehistoric times. Meat production is one of the main parts of agriculture, which is important for human nutrition. The demands for meat have been increased with an increase on human population. Production of high-quality meat is one of the main goals of breeding farm animals as well as sufficient meat production to meet market demands. Meat production is one of the main parts of agriculture, which is important for human nutrition. The demands for meat have been increased with an increase on human population. Production of

high quality meat is one of the main goals of breeding farm animals as well as sufficient meat production to meet market demands.

2.5. Proximate analysis

Proximate analysis refers to the quantitative analysis of macromolecules in food. A combination of different techniques, such as extraction, Kjeldahl, NIR are used to determine protein, fat, moisture, ash and carbohydrates levels.

This method partitioned nutrients in feed into 6 components: water, ash, crude protein, ether extract, crude fiber and NFE. Moisture is determined by the loss in weight that occurs when a sample is dried to a constant weight in an oven.

2.6. Importance of feed analysis

Laboratory analyses of feeds provide the best indication of nutrient availability, allowing feeds to be utilized to their full potential. Reliable nutritional information is important to not only balance rations, but also allows ration balancing programs to determine the most economical ration that will meet the animals' requirements. Although most producers have a good understanding of the concepts of feed ingredients (for example, dry matter, protein, starch etc.), some are unsure of what a laboratory analysis report is telling them. This factsheet will assist producers to have a better understanding of these analytical reports, provide definitions of key terms included in feed analysis reports and provide an example of a laboratory report. Although the layout of reports may be different between laboratories, the parameters indicated are included in most feed analysis reports (Cooke, 1988).

Most producers understand the established concept of crude protein, but modern feed analysis reports will also report the availability of protein as a measure of its digestibility, as well as different fractions of crude protein, including by-pass protein, non-protein nitrogen, etc. Both wet chemistry and Near Infrared Spectroscopy (NIR) are methods commonly used to create an analysis report. Wet chemistry measures the nutritional value using heat and chemicals to break down the forage. NIR estimates the nutritional value of the feed using light reflection rather than chemistry to identify and measure amounts of compounds in a sample. The reflectance values

of variability in the feed constituents of compound feeds. This could be due to the use of low-quality feed stuffs due to lack of strict quality control measures. So, there is a need for better quality standards for feed ingredients and compound feeds through analysis. There is a need for creating awareness among the feed compounders and consumers regarding maintaining the feed quality and its benefits in creating the trust between the compounders and farmers leading to better livestock productivity.

Kamal et al. (2020) revealed that the values claimed by the manufacturers are quite different from the actual analyzed values. This is a matter of concern and needs to be checked through better quality control measures by systematic feed analysis and ensure that manufacturers declare the true composition of the marketed feeds.

M Mamun-Ur-Rashid et al. (2013) Bangladesh Animal Feed Rules 2013 are reported that Maximum or Minimum Ideal Amount of Nutrition of Total Ration (TMR) of Growing Cow or Adult Bull and Maximum or Minimum Ideal Amount of Nutrition of Total Ration (TMR) of Dairy Cow.

Table 1: Maximum or Minimum Ideal Amount of Nutrition of Total Ration (TMR) of Dairy Cow

Description of Nutrition	Unit	Level	Milk Replacer	Calf Starter
Moisture	% Food	Maximum	10.0	10.0
Metabolizable Energy (ME)	MJ/KG DM	Minimum	10.0	8.30
TDN	%	Minimum	66.0	57.0
Crude Protein	% DM	Minimum	10. 0	7. 70
Digestible Crude Protein	%DM	Minimum	6.20	3.60
Ether Extract	%DM	Minimum	2.0	2.0
Crude Fiber	%DM	Maximum	15.0	15.0

Special Note: DM = Dry Matter; TDN = Total Digestible Nutrient; TMR = Total Mixed Ration

Table 2: Maximum or Minimum Ideal Amount of Nutrition of Total Ration (TMR) of Growing Cow or Adult Bull

Description of Nutrition	Unit	Level	Milk Replacer	Calf Starter
Moisture	% Food	Maximum	10.0	10.0
Metabolizable Energy (ME)	MJ/KG DM	Minimum	10.0	8.30
TDN	%	Minimum	66.0	57.0
Crude Protein	% DM	Minimum	10. 0	7. 70
Digestible Crude Protein	%DM	Minimum	6.20	3.60
Ether Extract	%DM	Minimum	2.0	2.0
Crude Fiber	%DM	Maximum	15.0	15.0

Special Note: DM = Dry Matter; TDN = Total Digestible Nutrient; TMR = Total Mixed R

Chapter 3

Methodology

Methodology is the whole process of study. Methodology of research is the specific techniques that used to identify process and analysis information about a specific topic. Methodology may be understood as sign of studying how research is done (Kothari,1990). All method and procedure followed in this research are discussed in present chapter.

3.1. Experimental Procedure

3.1.1 Sample Collection and Preparation

Feed samples, both for beef fattening and milk production were collected from different company at different sell points of Khulna division, Bangladesh. They are regarded as Company 1, Company 2, Company 3, Company 4, Company 5 and Company 6. Laboratory evaluation of manufactured feeds to ensure the nutrients contents.

3.1.2 Calculation of Standard Nutrient:

a. Nutrient requirement for beef fattening (Perry et al. 1999)

Components	Standard nutrients for beef fattening	Standard nutrients for milk production
Dry matter %	86	86
Moisture %	14	14
Crude Protein %	10	19
Crude Fibre %	15	17
Ash%	15.12	15
Ether Extract %	3	3
NFE %	42.88	45.07
CHO %	56.88	31.07
GE kcal/kg	333.408	338.28
Calcium %	0.3	0.77
Phosphorus %	0.19	0.49
TDN %	88.63	87.82

N.B.: This calculation of nutrient requirement was computed based on the information of body weight, daily weight gain, daily milk production, milk fat percentage and feed manufactures' logic in Bangladesh.

3.2.1 Proximate composition analysis:

The proximate analysis including moisture, mineral matter or total ash, crude protein (CP), crude fat or ether extract (EE), crude fiber (CF), and nitrogen-free extract (NFE) of the feed samples was performed according to SAS, 2009.

Assessment of chemical properties: To determine the chemical properties, the samples were subjected to the proximate analysis. Proximate analysis of feed samples will be done according to AOAC (1990).

Crude Protein Analysis:

Test Procedures:

Digestion: 1g of sample was weighted with an accuracy of ±0.1mg. For each sample 2 catalyst and 12ml H_2SO_4 were added and then placed into digestion block. The temperature of the digestion block was taken at 420°C and sample was heated for 60 minutes until the fumes stopped. Then the sample was taken to cool 50-60°C.

Distillation: After cooling the sample, it was mixed with 50ml distilled water. 50ml NaOH was added with the solution. The digestion flask was then given into the distillation chamber. 30ml Boric acid solution was taken in a conical flask and 3 drops of indicator were added into it. The water flow was previously adjusted. The distillation process was done until the colour of indicator mixture solution did not turn into green colour.

Titration: The sample of the flask was then taken for titration. Then 0.1% H_2SO_4 was taken in burette pipe and added drop wise. The procedure was continued until the colour of the solution of the conical flask turn from green to blue. When the solution colour had changed the titration procedure ended. The strength of the titrate was then recorded.

$$\textbf{Calculation} = \frac{(\text{ml H2SO4 sample} - \text{ml H2SO4 blank}) \times \text{conc.H2SO4 } 14.007 \times 100}{\text{Wight of sample} \times 1000}$$

Crude Fiber Analysis:

Test Procedures: 1g sample was taken in crucibles were fixed with the channels. 150 ml 1.25% H_2SO_4 was taken in the flask of the analyzer adding 3-5 drops n-octanol as anti-foam agent. The

switch of the fiber analyzer is turned on. Boil exactly for 30 minutes. After 30 minutes, filter the remaining agent. Washing should be done three times with 30 ml (crucible filled to the top) of hot deionized water, connecting each time to compressed air for stirring the content of crucible. After draining last wash,150 ml 1.25% KOH and 3-5 drops of anti-foam agent were added. Again, after boiling for 30 minutes then washing 3 times, a last washing was done with cold deionized water to cool the crucible and then wash three times the crucible content with 25ml of acetone and stirring by compressed air. the crucible content with 25 ml of acetone was washed. After that crucibles were dried at 105° C for one hour in oven and then cooled down in a desiccator to take the dry weight (F_1). The crucibles were placed into a muffle and heated up to 550° C for three hours to reweight after cooling in a desiccator (F_2).

Calculation: Crude Fiber (%) $= \frac{F1-F2}{F0} \times 100$

Where,
F_0 = Weight of sample in gram
F_1= Weight of oven dried sample in gram
F_2= Weight of ash containing crucible in gram

Ether Extract

Test method procedure:

Sample: 3 g (F1) of grounded and homogenized material was weighed in an extraction thimble with 1 mg proximation. Total weight- thimble weight = wet sample weight.

Chemicals: petroleum ether 40-60° C, with an evaporation of residue not higher than 10mg/l.

Sample drying: dried the thimble one hour in a 125° C oven.

Immersion: sample containing thimble or the glass crucible containing dry hydrolysed sample were introduced into the extraction equipment. After weighing extract collecting vessel (F2), 40ml of petroleum ether was added. Thimble with sample, assembled with thimble connector to extraction unit. After closing the extraction unit, the cooling water flow started and the heating. When the solvent started boiling, the thimble or glass crucibles were placed into "Immersion" position for 30 minutes.

Washing: after 30 minutes extracted, thimble or glass crucible were placed into "Washing" position for 60 minutes.

Recovery: after washing, the stopcock located under the water, was closed and cooled in condenser and evaporated completely the solvent from the extraction vessel.

Weighing: the extract containing cups were dried in oven at 125° C for 30 minutes and weighed (F3) it after cooling a desiccator.

Calculation: Ether Extract (%) $= \frac{W3-W2}{W1} \times 100$

Where,
W_1 = Weight of sample in gram
W_2 = Weight of empty vessel in gram
W_3 = Weight of vessel and ether extract in gram

Dry matter

Test procedure

Envelopes were weighted (W1) and weight was recorded to 0.001g. After harvesting, fresh shoot weight (W2) of forage was taken and the envelope was filled with sample and dried in oven for 24 hours at 105°C. Thereafter the dried sample containing envelope(W3) is weighted.

Calculation: Dry Matter (%) $= \frac{W3-W1}{W2} \times 100$

Where,
W_1 = Weight of envelope in gram
W_2 = Weight of fresh sample in gram
W_3 = Weight of envelope and dried sample in gram

Ash Analysis

Test Procedure

Crucibles were placed in muffle furnace, allowing 30 minutes to reach 600°C. Weight of crucible was recorded to 0.0001g (W_1). About 3g sample was weighted into a crucible which had been tarred. Weight of sample was recorded to 0.0001g (W_2). Ash crucibles containing

samples in muffle furnace at 600°C for 6 hours after the furnace had reached the temperature. Crucibles were allowed to cool in furnace to less than 20°C and crucibles were placed in desiccator with a vented top. Crucibles were cooled in desiccator to room temperature and were weighed immediately. Weight was recorded to 0.0001g (W_3). Ash% was calculated and reported to one decimal place.

Calculation: $\text{Ash (\%)} = = \frac{W3-W1}{W2} \times 100$

Where,

W_1 = Weight of crucible in gram
W_2 = Weight of sample in gram
W_3 = Weight of crucible and ash in gram

Calculation of Formulas:

GE = 5.7 × Protein + 9.4 × Fat + 4.1 × (NFE + Fiber) Kcal/kg (AR Son, 2017).

3.3.1 Layout of the experiment

a. Beef fattening

Treatment	R_1	R_2	R_3
T_0	T_0R_1	$T_0 R_2$	$T_0 R_3$
T_1	$T_1 R_1$	$T_1 R_2$	$T_1 R_3$
T_2	$T_2 R_1$	$T_2 R_2$	$T_2 R_3$
T_3	$T_3 R_1$	$T_3 R_2$	$T_3 R_3$
T_4	$T_4 R_1$	$T_4 R_2$	$T_4 R_3$
T_5	$T_5 R_1$	$T_5 R_2$	$T_5 R_3$
T_6	T_6R_1	T_6R_2	T_6R_3

T_0=Calculated value (Standard), T_1=Company 1, T_2=Company 2, T_3=Company 3, T_4=Company 4, T_5=Company 5, T_6=Company 6

b. Milk Production

Treatment	R_1	R_2	R_3
T_0	T_0R_1	T_0R_2	T_0R_3
T_1	T_1R_1	T_1R_2	T_1R_3
T_2	T_2R_1	T_2R_2	T_2R_3
T_3	T_3R_1	T_3R_2	T_3R_3
T_4	T_4R_1	T_4R_2	T_4R_3
T_5	T_5R_1	T_5R_2	T_5R_3
T_6	T_6R_1	T_6R_2	T_6R_3

T_0=Calculated value (Standard), T_1=Company 1, T_2=Company 2, T_3=Company 3, T_4=Company 4, T_5=Company 5, T_6=Company 6

3.3. Statistical analysis

Data was evaluated separately by using the analysis of variance (ANOVA). Mean differences were assessed by the Duncan New Multiple Range Test. Calculated data on various parameters under study were analyzed using 'SPSS' software.

Chapter 4

Results and Discussion

4.1 Milk production:

It is shown in Table 3 that the highest DM was 90.19% in T_3 while the lowest DM of milk production feed was 84.10% in T_5 and the calculated standard value (T_0) was 86.00%. DM% was not significantly ($p>0.05$) affected while comparing company feeds for milk production feed with standard calculated value. It also reveals from the Table 3 that highest CP% was obtained in T_1 (12.78%) and the lowest was found in T_2 (7.47%) in company feeds and the calculated standard value (T_0) was 19.00% which was highly significantly ($p<0.001$) differed. The highest moisture% was obtained in T_5 (15.89%) and the lowest was found in T_1 (9.23%) in company feeds and the calculated standard value (T_0) was 14% which was non significantly ($p>0.05$) differed. The highest CF% was obtained in T_5 (10.10%) and the lowest was found in T_4 (6.60%) in company feeds and the calculated standard value (T_0) was 17% which was not significantly ($p>0.05$) differed. The highest ash% was obtained in T_3 (17.52%) and the lowest was found in T_4 (12.13%) in company feeds and the calculated standard value (T_0) was15% which was not significantly ($p>0.05$) differed. The highest EE% was obtained in T_6 (3.07%) and the lowest was found in T_2 (1.43%) in company feeds and the calculated standard value (T_0) was 3% which was non significantly ($p>0.05$) differed. The highest NFE% was obtained in T_2 (54.45%) and the lowest was found in T_5 (46.16%) in company feeds and the calculated standard value (T_0) was 45.07% which was non significantly ($p>0.05$) differed.

Table 3: composition (Mean ± SE) of milk production feed

Treatments	Dry matter%	Moisture%	Crude Protein%	Crude Fiber%	Ash%	Ether Extract%	NFE%
T_0	86	14	19[a]	17	15	3	45.07
T_1	89.38±0.48	9.23±0.91	12.78±0.38[b]	10.04±0.83	16.85±0.28	2.61±0.42	48.49±2.27
T_2	89.86±0.65	9.25±.22	7.47±0.07[e]	10.04±0.99	17.33±2.48	1.43±1.16	54.45±0.48
T_3	90.19±0.18	9.86±0.24	11.25±0.1[bcd]	9.27±0.45	17.52±1.45	2.13±0.09	49.97±1.26
T_4	86±3.31	11.57±0.89	12.05±0.88[bc]	6.60±1.53	12.13±1.15	1.89±1.02	55.75±3.70
T_5	84.10±2.60	15.89±2.60	9.34±0.06[de]	10.10±0.07	16.02±1.29	2.47±0.44	46.16±1.62
T_6	89.82±0.65	12.76±1.93	9.71±0.24[cde]	7.45±0.19	15.68±0.91	3.07±0.03	51.33±2.83
p	0.2	0.09	0.00	0.09	0.22	0.64	0.15

*T_0=Calculated value (Standard), T_1=Company 1, T_2=Company 2, T_3=Company 3, T_4=Company 4, T_5=Company 5, T_6=Company 6; Means with different superscripts in a column differ significantly; NS=non-significant, ***=p<0.001, **=p<0.01, *=p<0.05*

It is shown in table 4 that the highest CHO% was obtained in T_2 (45.2%) and the lowest was found in T_5 (30.27%) in company feeds and the calculated standard value (T_0) was 31.07% which was non significantly ($p>0.05$) differed. The highest GE was obtained in T_6 (399.77kcal/kg) and the lowest was found in T_5 (211.1kcal/kg) in company feeds and the calculated standard value (T_0) was 338.28kcal/kg which was non significantly ($p>0.05$) differed. The highest calcium% was obtained in T_4 (0.73%) and the lowest was found in T_1 (0.57%) in company feeds and the calculated standard value (T_0) was 0.77% which was non significantly ($p>0.05$) differed.

Table 4: composition (Mean ± SE) of milk production feed

Treatments	CHO%	GE kcal/kg	TDN%	Calcium%	Phosphorus%
T_0	31.07	338.287	87.82[a]	0.77	0.49
T_1	39.27±3.17	268.4±6	67.96±1.0[ab]	0.57±0.07	0.38±.05
T_2	45.2±0.7	251.45±5.24	65.94±4.39[b]	0.6±0.11	0.39±0.05
T_3	40.1±0.7	257.75±6.24	65.41±1.83[b]	0.70±0.05	0.47±0.01
T_4	44.19±1.51	274.42±4.57	67.1±1.63[b]	0.73±0.14	0.42±0.15
T_5	30.27±4.59	211.1±6.20	55.31±3.39[b]	0.65±0.07	0.4±0.01
T_6	38.57±4.23	399.77±6.72	54.97±2.82[b]	0.66±0.05	0.39±0.025
p	0.17	0.56	0.04	0.78	0.46

*T_0=Calculated value (Standard), T_1=Company 1, T_2=Company 2, T_3=Company 3, T_4=Company 4, T_5=Company 5, T_6=Company 6; Means with different superscripts in a column differ significantly; NS=non-significant, ***=p<0.001, **=p<0.01, *=p<0.05*

It is shown in table 5 that the highest phosphorus % was obtained in T_3 (0.47%) and the lowest was found in T_1 (0.38%) in company feeds and the calculated standard value (T_0) was 0.49% which was non significantly ($p>0.05$) differed. The highest TDN % was obtained in T_1 (67.96%) and the lowest was found in T_6 (54.97%) in company feeds and the calculated standard value (T_0) was 87.82% which was significantly ($p<0.05$) differed.

Comparison between packet value and analysis value of milk production feed

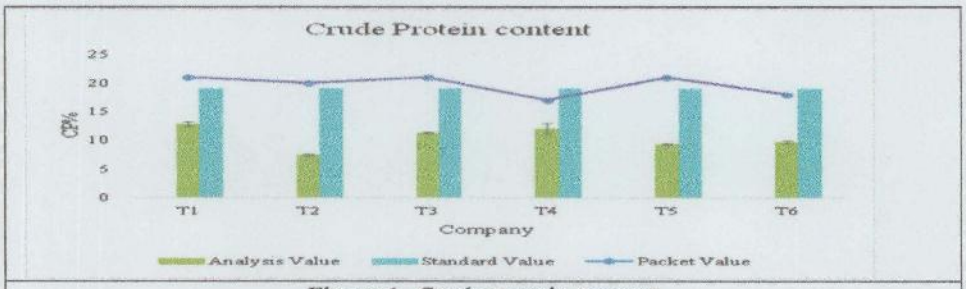

Figure 1- Crude protein content

Figure 1:In figure 1 analyzed percent of CP content was much lower than manufacturers' CP % value. In all manufactured feeds the CP content was lower than those of the calculated standard CP content of milk production feed.

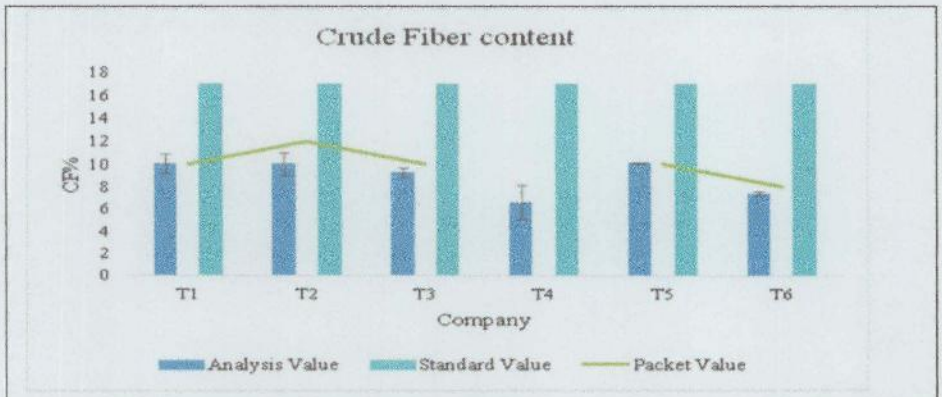

Figure 2- Crude fiber content

Figure 2: In figure 2 the standard value of CF content was much higher than the packet value and analyzed value of feed.

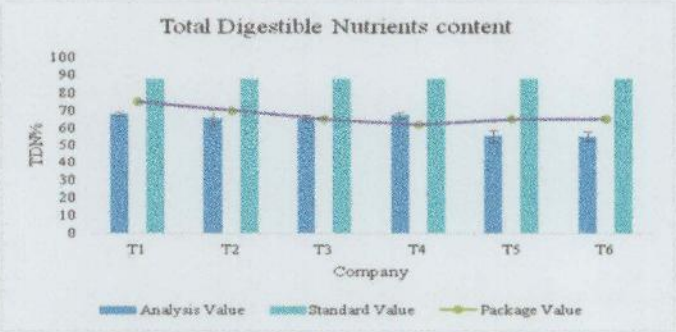

Figure 3- TDN content

Figure 3:In figure 3 analyzed value of TDN% was slightly lower than packet value.

4.2 Beef fattening:

It is shown in Table 5 that the highest DM was 89.85% in T_3 while the lowest DM of beef fattening feed was 88.81% in T_2 and the calculated standard value (T_0) was 86% DM% which was not significantly ($p>0.05$) affected while comparing company feeds for beef fattening feed with standard calculated value. It also reveals from the Table 5 that highest CP% was obtained in T_3 (10.76%) and the lowest was found in T_1 (7.64%) in company feeds and the calculated standard value (T_0) was 10% which was not significantly ($p>0.05$) differed. The highest moisture% was obtained in T_5 (10.94%) and the lowest was found in T_3 (8.87%) in company feeds and the calculated standard value (T_0) was 14% which was non significantly ($p>0.05$) differed. The highest CF% was obtained in T_5 (9.6%) and the lowest was found in T_3 (4.91%) in company feeds and the calculated standard value (T_0) was 15% which was non significantly ($p>0.05$) differed. The highest ash% was obtained in T_6 (16.99%) and the lowest was found in T_4(11.46%) in company feeds and the calculated standard value (T_0) was 15.12% which was non significantly ($p>0.05$) differed. The highest EE% was obtained in T_2 (3.86%) and the lowest was found in T_4 (1.50%) in company feeds and the calculated standard value (T_0) was 3% which was non significantly ($p>0.05$) differed. The highest NFE% was obtained in T_4 (50.14%) and the

lowest was found in T_6 (39.18%) in company feeds and the calculated standard value (T_0) was 56.88% which was non significantly ($p>0.05$)

Table 5: Proximate composition (Mean ± SE) of beef fattening feed

Treatments	Dry matter %	Moisture %	Crude Protein %	Crude Fiber %	Ash %	Ether Extract %	NFE %
T_0	86	14	10	15	15.12	3	56.88
T_1	89.7±0.35	10.33±0.32	7.64±1.17	8.7±0.81	14.63±0.81	1.51±0.63	46.84±2.8
T_2	88.81±1.49	9.45±0.5	9.38±0.80	8.37±1.27	15.69±1.94	3.86±0.005	43.93±3.56
T_3	89.85±0.16	8.87±0.81	10.76±0.31	4.91±0.48	15.05±1.46	2.22±0.47	49.30±1.42
T_4	89±0.135	9.94±0.37	8.52±0.47	8.48±1.80	11.46±2.13	1.50±0.125	50.14±3.79
T_5	89.76±0.70	10.94±0.08	9.25±0.45	9.6±0.44	16.88±0.52	2.77±0.14	39.61±1.45
T_6	89.65±1.05	10.45±0.93	7.93±1.16	7.55±0.45	16.99±0.02	2.41±1.49	39.18±0.06
p	0.9	0.28	0.21	0.14	0.18	0.28	0.08

*T_0=Calculated value (Standard), T_1=Company 1, T_2=Company 2, T_3=Company 3, T_4=Company 4, T_5=Company 5, T_6=Company 6; Means with different superscripts in a column differ significantly; NS=non-significant, ***=$p<0.001$, **=$p<0.01$, *=$p<0.05$*

It is shown in Table 6 that the highest CHO% was obtained in T_4 (60.08%) and the lowest was found in T_5 (50.55%) in company feeds and the calculated standard value (T_0) was 56.88% which was non significantly ($p>0.05$) differed. The highest GE was obtained in T_3 (289.25 kcal/kg) and the lowest was found in T_6 (236.12)kcal/kg in company feeds and the calculated standard value (T_0) was 333.40 kcal/kg which was non significantly ($p>0.05$) differed. The highest Calcium % was obtained in T_4 (0.35%) and the lowest was found in T_6 (0.15%) in company feeds and the calculated standard value (T_0) was 0.3% which was non significantly ($p>0.05$) differed.

Table 6: Energy and mineral composition (Mean ± SE) of beef fattening feed

Treatments	CHO %	GE kcal/kg	TDN %	Calcium %	Phosphorus %
T_0	42.88	333.408	88.63	0.3	0.19
T_1	57.17±2.48	258.55±9.95	66.59±2.24	0.15±0.05	0.13±0.025
T_2	53.23±2.91	278.65±18.5	65.9±7.6	0.25±0.05	0.11±0.015
T_3	58.18±0.61	289.25±0.85	70.06±0.96	0.15±0.05	0.13±0.02
T_4	60.08±4.165	276.79±9.9	70.47±1.33	0.35±0.05	0.13±0.04
T_5	50.55±1.37	250.75±4.15	64±0.165	0.15±0.05	0.15±0.03
T_6	54.64±4	236.12±21.42	60.09±5.03	0.15±0.04	0.16±0.02
p	0.16	0.32	0.49	0.11	0.81

*T_0=Calculated value (Standard), T_1=Company 1, T_2=Company 2, T_3=Company 3, T_4=Company 4, T_5=Company 5, T_6=Company 6; Means with different superscripts in a column differ significantly; NS=non-significant, ***=$p<0.001$, **=$p<0.01$, *=$p<0.05$*

The highest Phosphorus % was obtained in T_6 (0.16%) and the lowest was found in T_2 (0.11%) in company feeds and the calculated standard value (T_0) was 0.19% which was non significantly ($p>0.05$) differed. The highest TDN % was obtained in T_1 (70.47%) and the lowest was found in T_6 (60.09%) in company feeds and the calculated standard value (T_0) was 88.63% which was non significantly ($p<0.05$) differed.

Comparison between Packet value and Analysis value of beef fattening feed

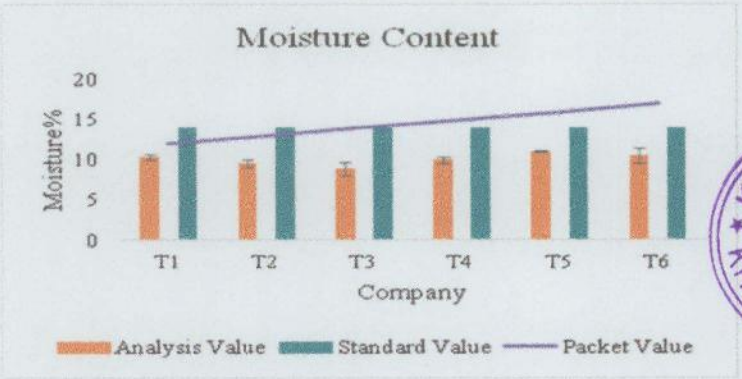

Figure 4- Moisture content

Figure 4: In figure 4 analyzed percent of moisture content was much lower than manufacturers' moisture % value. In all manufactured feeds the moisture content was lower than those of the calculated standard moisture content of beef fattening feed except the manufactured feeds of T_1, T_2 and T_3.

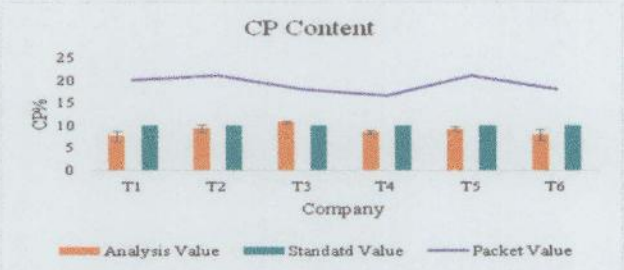

Figure 5- CP content

Figure 5: In figure 5 analyzed CP content of all manufactured feed was much lower than those of the manufactured packet value. Similarly, the standard calculated value of CP content was to some extent similar with the CP content of manufactured feed of the companies.

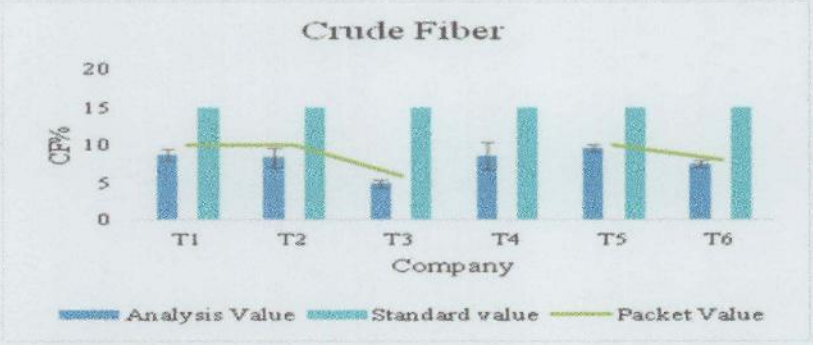

Figure 6- CF content

Figure 6: In figure 6 analyzed CF content of manufactured feed was found to be close with the manufactured packet value. The standard calculated value of CF content was much higher than that of the manufactured and analyzed value.

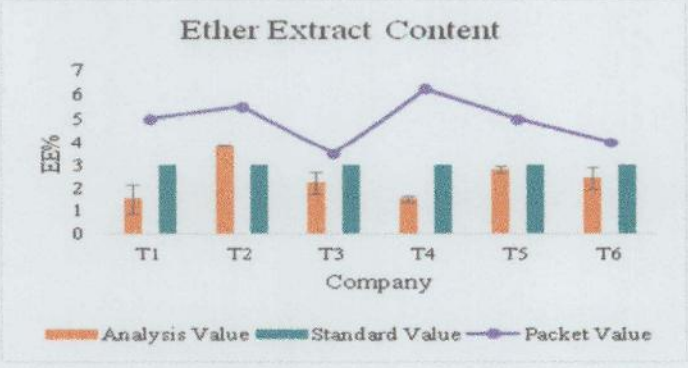

Figure 7- Ether Extract content

Figure 7: In figure 7 analysis value of EE of companies' feed was much lower than that of manufacturers' packet value. Similarly, standard calculated value of EE content was lower than that of packet analysis value of all companies' feed.

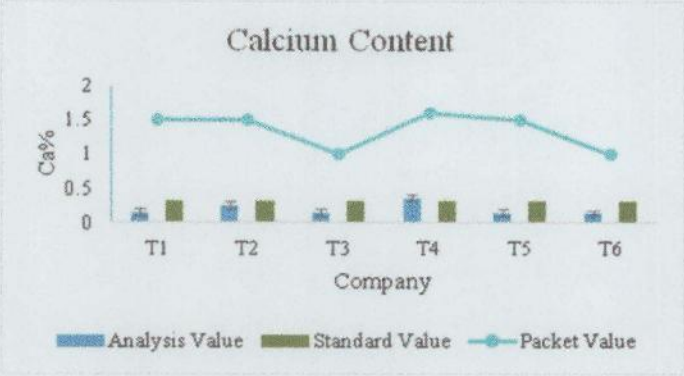

Figure 8- Calcium content

Figure 8: In figure 8 analyzed calcium content of all companies' feed was much lower than the manufacturers' packet value. Similarly, standard calculated value of calcium content was lower than that of manufacturers' packet value.

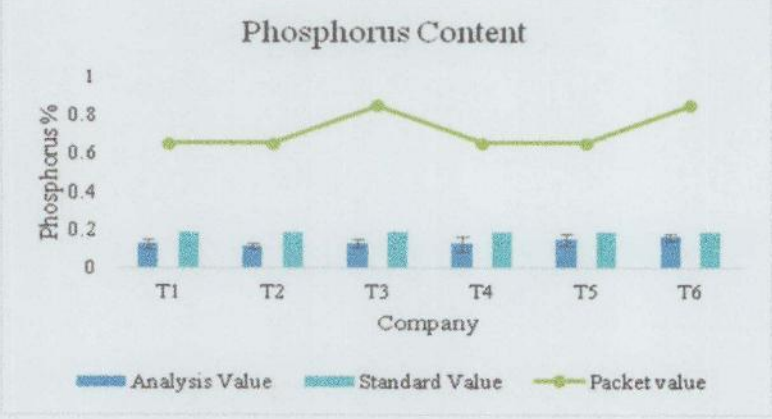

Figure 9- Phosphorus content

Figure 9: In figure 9 analyzed phosphorus content of companies' feed was much lower than that of manufacturers' packet value.

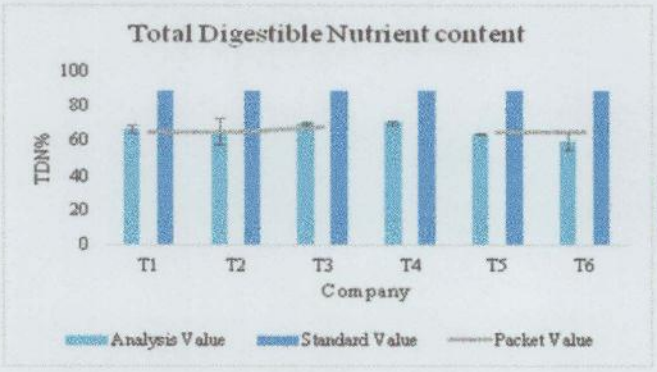

Figure 10- TDN content

Figure 10: In figure 10 analyzed TDN content of feed was similar with manufacturers packet value. Standard calculated TDN value was higher than that of companies feed.

CHAPTER -5

SUMMARY AND CONCLUSION

The study was conducted to evaluate the nutritional quality and compare of manufactured feeds for beef cattle and milch cow supplied feed industries of Bangladesh. The feeds for beef cattle and milch cow collected from local animal feed sale points of Khulna district. In case feed for milk production, highest DM was 90.19% in T_3 while the lowest DM of milk production feed was 84.10% in T_5 and the calculated standard value (T_0) was 86.00%. DM% was not significantly ($p>0.05$) differed while comparing company feeds for milk production feed with standard calculated value. Highest CP% was obtained in T_1 (12.78%) and the lowest was found in T_2 (7.47%) in company feeds and the calculated standard value (T_0) was 19.00% which was highly significantly ($p<0.001$) differed. Highest GE was obtained in T_6 (399.77kcal/kg) and the lowest was found in T_5 (211.1kcal/kg) in company feeds and the calculated standard value (T_0) was 338.28kcal/kg. Highest TDN % was obtained in T_1 (67.96%) and the lowest was found in T_6 (54.97%) in company feeds and the calculated standard value (T_0) was 87.82% which was significantly ($p<0.05$) differed. In case feed for beef fattening, highest DM was 89.85% in T_3 while the lowest DM of beef fattening feed was 88.81% in T_2 and the calculated standard value (T_0) was 86% DM%. Highest CP% was obtained in T_3 (10.76%) and the lowest was found in T_1 (7.64%) in company feeds and the calculated standard value (T_0) was 10%. The highest GE was obtained in T_3 (289.25 kcal/kg) and the lowest was found in T_6 (236.12kcal/kg) in company feeds and the calculated standard value (T_0) was 333.40 kcal/kg. The highest TDN % was obtained in T_1 (70.47%) and the lowest was found in T_6 (60.09%) in company feeds and the calculated standard value (T_0) was 88.63% which was non significantly ($p<0.05$) differed. It may be infered that the investigated feeds collected from different locations of Khulna division are inconsistent among analysis value, packet value and lower in nutrient composition when compared to standard calculated value.

Chapter 6

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