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ESTIMATION OF MOISTURE AND CRUDE PROTEIN CONTENT OF LOCALLY AVAILABLE RAW MATERIALS FOR POULTRY FEED

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ABSTRACT: There are some locally available domestic material in our country that can be used in poultry feed. The uses of local material will decrease the feed cost as well as ensure the availability of raw materials. In this investigation we have selected twelve locally available domestic materials that are low cost and nutritious for poultry health. These raw materials play an important role on poultry health. For crude protein estimation we have used manual micro Kjeldahl method. We have applied also micro Kjeldahl automated Foss instrument to measure and compare results of crude protein content of our selected raw materials. Moisture content of these raw materials is also estimated by three different methods, because moisture plays an important role during storing and formulation of poultry feed. In this study it was found that all of the local raw materials contain considerable amount of crude protein. Though all the selected raw materials contain considerable amount of crude protein, among them soya bean meal (SBM) contains higher amount of crude protein (46.53%)

INTRODUCTION: Bangladesh is an agricultural and developing country. Now a day's agribusiness is growing up very fast in Bangladesh. Most of the establishment uses foreign raw materials [1] for producing poultry feed. If we can introduce locally available domestic material such as corn [2], rice bran, paddy, soya bean meal, mustard meal, wheat bran etc. those contains appreciable amount of nutritious values, and then many companies will start to use domestic material.

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As a result the demand of domestic material will be increased day by day as well as the feed price will be reasonable for poultry farmers. On the other hand the raw materials are no need to import from foreign country. So company can save cost in this regard. These raw materials may contain different nutrients, such as, carbohydrate, moisture, protein [3], fat, fiber and calcium etc. which has a great influence on poultry health. Among these nutrients, protein is considered as a main constituent to build up the poultry health. The present study was undertaken to introduce only protein content of some domestic material that can be used as poultry feed raw materials. Specially for measuring crude protein (CP)[4], Micro Kjeldahl process [5, 6] is used. Micro Kjeldahl process is reliable for measuring crude protein.

TABLE 1: LIST OF LOCALLY AVAILABLE POULTRY FEED RAW MATERIALS

Sl No.	Short Name (Raw Material)	Full Name (Raw Material)	Origin
1	CORN	Corn	Bangladesh
2	RBF	Rice Bran Fresh	Bangladesh
3	RBC	Rice Bran Coarse	Bangladesh
4	SBM	Soya Bean Meal	Bangladesh
5	BR	Broken Rice	Bangladesh
6	PDY	Paddy	Bangladesh
7	WBC	Wheat Bran Coarse	Bangladesh
8	WHEAT	Wheat	Bangladesh
9	MSTD	Mustard Meal	Bangladesh
10	MSB	Mushuri Bran	Bangladesh
11	DORB	De-Oiled Rice Bran	Bangladesh
12	COM	Coconut Meal	Bangladesh

FIG. 1: PHYSICAL VIEW OF LOCALLY AVAILABLE POULTRY FEED RAW MATERIALS

MATERIALS AND METHOD:

Estimation of moisture:

Moisture is an important factor for a raw material to store or use in feed. Depending on the moisture range of a raw material we can store for different period. Not only store, it plays an important role during formation of feed. So, investigation was started by checking the moisture content of these raw materials.

PROCEDURE:

1. At first the petridis was cleaned by distilled water and was kept it into dryer for 10 min., after that the petridis was transferred to a desiccators for cooling.
2. Weight was taken of the dry petridis as M1.
3. The grinding sample was taken about 2-5 gm. in that dry petridis as M2.
4. The Petridis was then placed in an oven (oven temp. was previously set-up 105 Degree Celsius.) for 16 hrs.
5. After that the Petridis was transferred to desiccators for cooling.
6. Finally the weight of sample with petridis was recorded as M3.

Calculation:

$$\% \text{ Moisture} = \frac{\text{Weight loss x 100}}{\text{Weight of the sample}} \quad (1)$$

$$= \frac{\text{M2}-\text{M3 x 100}}{\text{M2}-\text{M1}}$$

Where,
M1= Weight of empty Petridis
M2= Weight of empty Petridis + sample
M3= Weight of empty Petridis + sample after dry

Estimation of crude protein:
In this investigation there are two process of Kjeldahl method were used to estimate and compare the crude protein content. i.e.:
i) Micro Kjeldahl method (Manual)
ii) Micro Kjeldahl method (Automated Foss Instrument)

Equipment's:

i) Grinder Machine (Particle size ≤ 1mm)

ii) Electronic Balance 4 Digit

iii) Spoon

iv) Tracing Paper

v)Graduated Measuring Cylinder, of capacity 25ml.

vi) Laboratory Fume Hood

vii) Digestion System Foss Tecator ™ 8 digester

viii) Scrubber ™ 2501 Tecator

ix) Digestion tube, of capacity 250 ml, suitable for use in digestion block.

x) Conical Flask

xi) Distillation System Kjeltec™ 8100

xii) Eyela-CA-1112E Water Cooler Systems

xiii) Puris-Expe RO Water System

xiv) Burette, of capacity 50ml

xv) Pipette (5ml, 10ml, and 25 ml.)

xvi) Reagent Bottle (250ml, 500ml)

xvii) Volumetric Flask (100ml, 250ml, 500ml, 1000ml)

Reagents:

i) For digestion : Catalyst Mixer ($CuSO_4$+ K_2SO_4, Mixing ration = 1:9) &Concentrated H_2SO_4 (98%)

ii) For distillation : Mixed indicator (Methyl red + Methylene blue), NaOH 50% solution&H_3BO_3 4% solution

iii) For Titration : 0.2 N H_2SO_4 solution.

Preparation of solution:

i) Phenolphthalein Indicator : 0.5gm. Phenolphthalein + 50 ml 95% Ethanol

ii) Mixed indicator : 0.2 gm. Methyl Red + 0.1 gm. Methylene Blue+ 150 ml 95% Ethanol+ Stirring

iii) 4% Boric acid solution: 40 gm. Boric acid + distilled Water = Total volume 1 lit. + 10 ml Mixed Indicator

iv) 50% NaOH : 500 gm. NaOH + distilled water = Total volume 1000 ml.

v) 0.2 N H_2SO_4 : 11 ml conc. 98% H_2SO_4 + 1989 ml distilled water = Total volume 2000 ml.

Standardization of 0.2 N H_2SO_4solution:
Approximate 0.1 gm. pure and dry $Na_2CO_3$was taken in a 250 ml conical flask and 50 ml distilled water was added and then it was titrated with H_2SO_4 solution in presence of 1 drop methyl red indicator. Then the normality of H_2SO_4 solution was calculated by the following equation.

$$\text{Normality of } H_2SO_4 \text{ sol.} = \frac{\text{Volume of Sulfuric aicd (ml) x Wt. of Sodium Carbonate (gm.) x 1000}}{\text{Equivalent wt. of Sodium Carbonate (gm.)}} \quad (2)$$

Digestion procedure:

i) Approximately 0.5 to 1 gm. of ground homogenous sample was taken in a piece of tracing paper. The paper is carefully folded so that, the sample is well contained. The folded sample was then placed into digestion tube.

ii) When the digestion unit has been on for an adequate warm-up period, then 15-20 ml of concentrated H_2SO_4 to each tube and also 4 gm. of catalyst mixer were added.

iii) After completing sample and reagent addition to the digestion tubes, it was carefully inserted into the holes provided in the flask rack or heating mantle.

iv) The exhaust fan of the digestion chamber was turned on.

v) The sample was then digested at 350^{0}C for approximately 120-150 minute or until the sample have a clear, blue-green appearance.

vi) After digestion was completed, the flask was removed from the rack or heating mantle. The hot tubes are carefully handled so that, it cannot come into contact with cool or wet surface. As a safety precaution gloves and goggles were used when removing the tubes from digester.

vii) The tubes were allowed to cool for 15 to 20 minutes. When the tubes have cooled enough then it was diluted with 50 ml of distilled water so that, the digested sample is fully dissolved.

Distillation procedure:

i) The digestion sample was transferred to the distillation unit

ii) 60 ml 50% NaOH solution was added to the unit very slowly.

iii) A receiving Erlenmeyer flask containing 25 ml boric acid solution was placed to collect the distillate.

iv) The distillate was collected up to 150 ml.

v) The distillate was then titrated with std. 0.2 N H_2SO_4 solution. (End point was violet-grey.)

Crude protein (% CP) calculation:

Crude protein is an estimate for total protein. A crude protein contains nitrogen from not only protein but non-protein sources as well. Crude protein is used for energy and helps build tissue. Crude Protein (CP) is based on a laboratory nitrogen analysis, from which the total protein content in a material can be calculated by multiplying the nitrogen figure by 100/16 or 6.25. This is from the assumption that nitrogen is derived from protein containing 16 % nitrogen (AOAC, 1984). However, some portion of the N in most raw materials are found as non-protein nitrogen (NPN) and, therefore, the value calculated by multiplying N x 6.25 is referred to as crude rather than true protein. Protein is made up of amino acids.

So normally %CP is calculated by the following equation:

$$\%\,CP = \frac{\text{Volume of Sulfuric acid (ml)} \times \text{Normality of Sulfuric acid} \times 14.007 \times 6.25 \times 100}{\text{Wt. of sample in mg}} \qquad (3)$$

A mixture of true protein and non-protein nitrogen in a material is called crude protein. The approximate amount of protein is calculated from the determined nitrogen content by multiplying by a factor (as 6.25 for many foods and 5.7 for wheat) derived from the average percentage of nitrogen that may contain an appreciable error if the nitrogen is derived from non-protein material or from a protein of unusual composition.

FIG. 2: FOSS DIGESTION UNIT

FIG 3: FOSS DISTILLATION UNIT

FIG. 4: FOSS-KJELDAHL FLASK

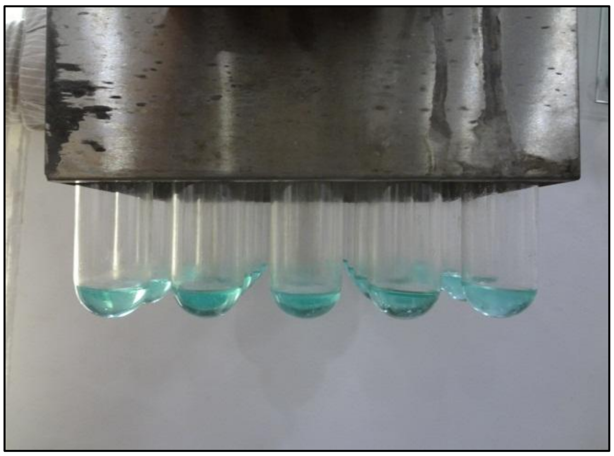
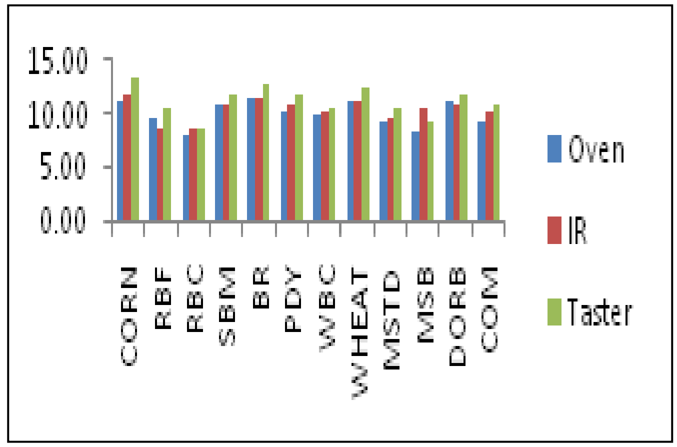


FIG. 5: AFTER DIGESTION

Manual digestion is comparatively time consuming then automatic foss digestion, but foss digestion is costly then manual. Heating system and arrangement for automatic foss digestion is totally different from manual. Under all consideration, automatic foss digestion is reliable, easy to handle and also environment friendly.

RESULTS AND DISCUSSION: The moisture content of different kinds of raw material has been compared between the oven method, IR method and normal moisture taster. Moisture taster is a simple and small machine by which grain moisture can measure within a very short time. But it is not reliable, only we can guise about the moisture level of the raw material. The results are given below. Same sample is used to measure %CP at different daysof interval. This investigation was done after seven day's interval within a month, because all of the raw materials are to stock for one or two month for using in feed. After storing for a long day's there is a possibility to deviate the nutrientslevel, so this research will ensure the nutritionist about the stability of %CP of these raw materials.



Raw Material Name

FIG. 6: PERCENTAGE MOISTURE LEVEL OF RAW MATERIALS BY DIFFERENT METHODS

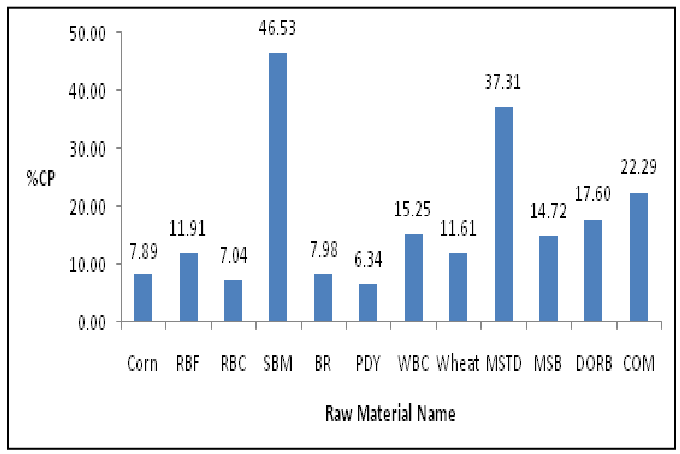


FIG. 7: PERCENTAGE CRUDE PROTEIN LEVEL OF RAW MATERIALS

TABLE 2: PERCENTAGE OF MOISTURE CONTENT OF LOCALLY AVAILABLE RAW MATERIALS (AT DIFFERENT METHOD)

Sl No.	Raw Material Name	Percent Moisture Method		
		Oven	IR	Moisture Taster
1	CORN	11.24	11.92	13.50
2	RBF	9.70	8.75	10.40
3	RBC	8.10	8.52	8.70
4	SBM	10.77	10.85	11.80
5	BR	11.62	11.45	12.80
6	PDY	10.35	10.72	11.80
7	WBC	9.82	10.11	10.60
8	WHEAT	11.22	11.15	12.30
9	MSTD	9.12	9.56	10.50
10	MSB	8.42	10.55	9.20
11	DORB	11.32	10.80	11.80
12	COM	9.12	10.22	10.80

The crude protein content of different kinds of raw material has been compared after seven days interval up to one month. The results are given below:

TABLE 3: PERCENTAGE OF CRUDE PROTEIN OF LOCALLY AVAILABLE RAW MATERIALS (AT DIFFERENT DAY'S INTERVAL)

Sl No.	Raw Material Name	Method	Percentage of Crude Protein				
			After o day	After 7 days	After 14 days	After 21 days	After 28 days
1	Corn	Micro Kjeldahl	7.88	7.75	7.92	7.95	7.95
		Automated Foss	7.75	7.80	7.81	7.85	7.98
2	RBF	Micro Kjeldahl	11.80	11.96	11.90	11.95	11.93
		Automated Foss	11.90	11.96	11.94	11.99	12.00
3	RBC	Micro Kjeldahl	6.88	6.96	7.10	7.10	7.18
		Automated Foss	7.12	7.12	7.16	7.20	7.22
4	SBM	Micro Kjeldahl	46.50	46.54	46.51	46.49	46.55
		Automated Foss	46.48	46.50	46.44	46.56	46.54
5	BR	Micro Kjeldahl	7.86	7.96	8.11	7.95	8.00
		Automated Foss	8.10	8.15	8.21	8.20	8.25
6	PDY	Micro Kjeldahl	6.28	6.25	6.33	6.38	6.44
		Automated Foss	6.39	6.40	6.44	6.54	6.61
7	WBC	Micro Kjeldahl	15.25	15.18	15.22	15.28	15.30
		Automated Foss	15.22	15.25	15.32	15.33	15.38
8	Wheat	Micro Kjeldahl	11.56	11.48	11.66	11.66	11.68
		Automated Foss	11.71	11.70	11.76	11.78	11.82
9	MSTD	Micro Kjeldahl	37.25	37.18	37.33	37.35	37.44
		Automated Foss	37.41	37.39	37.45	37.44	37.53
10	MSB	Micro Kjeldahl	14.68	14.72	14.72	14.75	14.74
		Automated Foss	14.77	14.75	14.78	14.82	14.82
11	DORB	Micro Kjeldahl	17.55	17.61	17.60	17.61	17.62
		Automated Foss	17.74	17.79	17.80	17.80	17.80
12	COM	Micro Kjeldahl	22.18	22.25	22.34	22.35	22.35
		Automated Foss	22.25	22.35	22.39	22.36	22.40

CONCLUSION: Fig. 7 shows that all of the raw materials contain considerable amount of %CP, among them SBM, MSTD and COM contain higher amount of %CP (46.53%, 37.31% and 22.29% respectively). Due to inadequate facilities and shortage of manpower we have considered only %CP in this study, but there are some positive future opportunities to estimate the rest of the nutrients of these raw materials. If all nutrients can estimate belongs to these raw materials then it will be more helpful for the nutritionist to formulate poultry feed.These raw materials easily can use in poultry feed, because these are locally available as well as low cost. If we can make a trend to use local raw material, then the demand of these material will be increased day by day and it will develop our agricultural market.

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